CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 DECEMBER 1948 SIDNEY D. KIRKPATRICK, Editor

"Smog Fighters"

OUR ARTICLE of this title in last month's issue preceded by only a few days the tragic experiences of Donora, Pa., where what we called "Public and Industrial Enemy No. 1" took a toll of almost a score of lives. Scientific study started immediately and state and federal authorities are still seeking the final answer as to the exact causes—natural and man-made. Meanwhile, however, there is a growing conviction that no community has the right to tolerate conditions that endanger the health and lives of its citizens.

What Los Angeles has done in organizing Science-Industry study and action groups sets a pattern that other industrial cities might well follow. The amount of smoke that is loosed into the atmosphere can nearly always be reduced by better combustion, properly controlled by engineering methods and equipment. Harmful dust and fumes can be removed if their sources and disposal are the subjects of scientific study. Wind and fog are, as yet, beyond human will, but recent scientific studies have yielded a great deal of helpful knowledge that is being put to good use in plant location and construction. Chemical engineers can become better citizens of their communities by contributing their knowledge and experience in dealing with the problems of atmospheric pollution.

Expanding Opportunities

DONALD HUNT, Industrial Coordinator of the University of Detroit, has been singularly successful in finding new engineering opportunities among the smaller companies of that area. As an example of his "bird-dog" work as a placement director, he cites the case of a relatively new company engaged in the manufacture and sale of detergents.

"The president of the company is a graduate chemical engineer, and two years ago his chief assistant was a 'shipping and receiving plant manager' type of individual whose duty it was to keep the barrels of chemicals coming in, mixing them together, and shipping them out. At that time the president was looking for a man to do a little 'test-tube' work in an old washing machine into which they threw greasy machine parts together with some of their detergents to see if the parts could be cleaned. This was their research laboratory.

"One of our chemical engineering seniors thought it looked like an opportunity, so he went to work setting up a well-organized laboratory with a little modern equipment for detergent investigations. Six months later he had developed some new detergents in his much improved laboratory, and as a result was given a sizable interest in the company. The senior has been a member of our faculty for the past year and has been working as a consultant for the Blank Chemical Co. Now he is going back with the company to direct a greater part of their work, including the training of some of our cooperative engineering students looking toward sales engineering careers."

Missionary work of this sort cannot be practiced through any national organization. It must be done at the local level through individual efforts of each college working in its own locality. We suspect that there will again come a time when other placement directors will find it profitable to practice such techniques in creating new engineering opportunities—in their own back yards, so to speak.

Scientific Good-Will

IT BEGINS to look as though science and technology may be facing a problem in public relations. More and more people are beginning to question our work. This is not merely a throwback to depression days when the economic planners were calling for a moratorium on research so that the social scientists could catch up with the procession. Rather, it is a more fundamental questioning of the ethical basis of our scientific materialism—perhaps a natural reaction from the ruthless advances in war's technology.

Scientists themselves are doing some soul-searching. *Fortune* magazine, in a rather sympathetic study last October, said "Man's world once again is in imminent danger of falling to pieces unless men struggle to use their knowledge to the right ends. . . . This, deepest of science's internal crises, has caused a wide re-examination of the sources and ultimate purposes of science." Dr. J. Robert Oppenheimer is quoted as having said, "In some crude sense, which no vulgarity, no humor, no overstatement can quite extinguish, the physicists have known sin; and this is knowledge they cannot lose."

The same magazine sent a questionnaire to 4,000 top scientists asking such questions as whether a scientist should withhold a discovery from the world if he knew it to be more productive of evil than good, or, alter-

natively, leave it to the moral sense of mankind to decide its ultimate use. Of the chemists and physicists so queried, 21 percent of each group favored withholding the results of such research. More than three-quarters felt that federal funds should be appropriated to help make up for the lag in the social sciences. Is this in any way an admission of guilt—or merely the recognition of the need for better balance between the spiritual and material forces?

Further evidence of some rather interesting thinking on this problem will be found in the little book by Charles A. Lindbergh, which is reviewed elsewhere in this issue. "Science," he writes, "has become the victim of its technologists, just as religion became the victim of its fanatics. Just as the spiritual truths were perverted by the temporal exploitation of Christian creed and dogma, so the intellectual truths of science are being perverted by the material exploitation of industry and war." His only answer lies in attaining a better balance of the mind, spirit and body of our people—an upgrading of the quality of our civilization.

"Peace on earth, good-will to men" takes on new significance in these troubled times.

A $16 Billion Business

More progress will be made during the next few years in reducing stream pollution than has been made in the past decade. One of the reasons is to be found in recent federal legislation that makes available more than $1 million a year for engineering and economic investigations. A recent survey by the U. S. Public Health Service indicates that an investment of about $8 billion will be needed for new facilities for protecting water supplies through adequate sewage, garbage and refuse disposal. Arthur D. Little, Inc., estimates that industry must spend a comparable amount for the treatment and disposal of industrial waste. This estimate is based on the wartime experience of the synthetic rubber industry which alone spent $14 million to treat wastes from its various plants.

Fortunately, in some instances, there will be offsetting returns through the recovery of valuable byproducts. Two rayon plants are today recovering $3 million worth of saltcake sorely needed by other industries. But whether it pays or not, the time is coming when the government will insist that industry do its part in cleaning up our streams and thereby protecting one of our most valuable resources.

"National Industrial Reserve"

By transfer of 15 manufacturing establishments from the government's list of surplus war plants, there has now been established under the Federal Works Agency a new National Industrial Reserve. This preparedness agency was authorized by Congress last June, and now comes into being to take over as its initial nucleus government-owned establishments to make aluminum, magnesium, armor plate, explosives, and other ordnance.

It will be comforting to know that the light metals and explosives and other emergency materials can come from such an establishment in case of military need. It is much better that there be this arrangement than that all wartime requirements be expected to come from sources which are equipped to make only the quantities normally needed in peacetime.

Whether or not it is possible or desirable to set up comparable reserve capacity for chemicals is still being debated. Today demand often exceeds supply without consideration of any possible military requirement. It is difficult, therefore, to see just how the government can establish comparable capacity for sulphuric acid or for caustic and chlorine, just to name two examples. But the principle is now set, and we must not be surprised to see it extended further into the chemical process industries.

"Monopoly"—New Style

Interpretation of the Anti-Trust law is being given a strange new twist, which seems silly to technologists, and, we believe, to others who are laymen in the law. The government has charged that the manufacturers of cellophane have illegally created for themselves a monopoly by their skill in constantly reducing the cost and the price of this popular material.

It is not strange that a spokesman for the Du Pont company rather resents the criticism of their efforts in this direction. We believe that chemical engineers and chemical executives generally will share the astonishment of Henry B. du Pont, who says: "We saw nothing socially undesirable in reducing prices on any article as rapidly as lower production cost permitted, even though it did have the natural effect of giving us a majority of the patronage. But now the argument seems to be that no company should get itself into that position, despite the fact that it got there through passing on economies in manufacture to its customers."

It is, indeed, a sorry state of affairs when those in high public office interpret the law in such a way as to restrict the efficiency of a company solely because it is successful and willing to share its success with its customers.

A Sound Rubber Program

Currently, the government-owned plants making synthetic rubber are being converted in large part to the manufacture of low-temperature copolymer. This is the final step in the development of a superior tire-tread rubber. It means that within a few weeks the makers of tires will have a better grade of rubber for compounding than ever before has been available to them on a large scale.

Of course, this is not a final achievement, for we have reason to expect still further improvement in methods and products from the synthetic rubber industry. But it does represent the culmination of the major wartime program which had as its prime purpose the making of America largely self-sufficient for high-quality tire rubber. It means that the tire user can expect to get more from a new tire made from "cold" rubber than he ever before got in the way of mileage and safety.

Manufacture of cold rubber at a rate of about 200,000 short tons per year furnishes a sound technical basis for a national program. Congress during the coming spring can safely proceed to the authorization of a commercial arrangement by RFC to put the bulk of the rubber-making business back into the hands of private enterprise.

Materials Handling

Trends

Examples

Case Histories

WHICH METHOD fills the bill? Industrial trucks as in Harbison-Walker's new refractories plant (p. 98) . . .

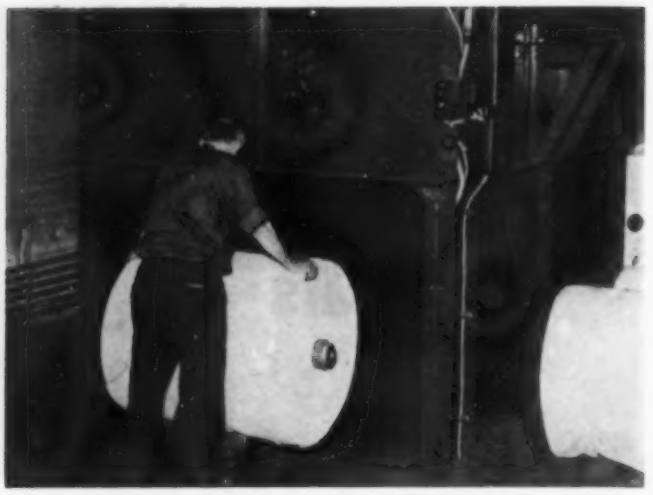
. . . or conveyors as at Noralyn (p. 100) carrying concentrates from plant to stock pile, dryer and shipping bins?

ACCORDING to those who should know, improvement in the materials handling set-ups of most sorts of process industries represents one of the biggest of all potentials for further manufacturing economies. This being the case, it is important for every present plant, and for the designers of every future plant, to make certain that the materials handling methods they use are the best ones for the purpose.

This is not a matter of equipment alone. It also must include the basic objectives to be accomplished. In one plant the fundamental need may be reduced handling cost; in another, safety; in a third, elimination of possible contamination; in still another, harmony with the process equipment. In other plants yet other objectives may be the ruling ones, or combinations of the ones mentioned. This means that the overall picture must be studied. Preconceived notions are out. Like one man's meat, what may be a good set-up for one plant can be poison for another making exactly the same product.

In this report we have tried, therefore, to show how the circumstances and the fundamental needs have governed handling methods in several particular cases. First, we have turned to an eminent consultant on materials handling problems to tell us what trends are apparent in applying this ubiquitous unit operation. Then, in the light of both the process and the fundamental needs, we have discussed materials handling in three totally different types of plant. One makes a single product on a tremendous tonnage basis. A second, faced with problems of plant housekeeping and contamination, makes only a few products which, however, are handled as small units. The third finds contamination to be the main problem, yet must deal with products and package sizes that are numbered in the thousands.

NEWCOMERS, like this vibrating car shake-out, are coming into use, but mostly for less usual applications.



OLD TIMERS such as elevators (above), belts, screws, and other types, continue to take big share of the load.

ADOLESCENTS, including the industrial truck family, are approaching maturity. The fork truck and palletized load, the tractor and trailer train, introduce a factor of skill into materials handling, but are mastered even by girls. Meanwhile, versatility of the fork truck extends to many special adaptations, such as the rotating type above.

MATERIALS HANDLING

Trends

In most cases the newcomers are supplementing the old timers, not replacing them.

WILBUR G. HUDSON
Consulting Engineer
Chicago, Ill.

THERE have been a number of definite trends since the War in the methods favored by materials handling specialists. Although most of the older equipment is still actively in use, and much of it, for example, belts, has seen recent improvement, some of the newer types have been forging ahead. To a considerable extent this has come about as a result of wartime experience. This is particularly true in the adaptation of heavy earth-moving machinery to uses in outdoor storage, and in the present widespread applications of the "unit load," the pallet and the fork truck.

From a process industry standpoint the materials handling problem may be divided roughly into four broad groups of operations including: (1) Unloading, (2) reserve storage, (3) inside storage, and (4) handling within and out of the plant. In what follows we shall take a brief look at present day trends in each of these four classifications.

Unloading

Car unloading routine has changed but little. In the last few years the growing use of small washed bituminous coal, often sticky, sometimes semi-frozen and sometimes really frozen, has called for equipment which would loosen up the load. Three devices have been developed, the Stephens-Adamson "Accelerator," a device with vertical screws driven down through the coal mass to loosen it into flowable condition; the Link Belt "Displacer," a heavy spud which slices off the coal; and the Robins "Shake-out," a heavy yoke which rests on the car sides and is agitated by a vibrator. Of course, these are of little avail with frozen coal. Then we must use thaw pipes injecting live steam into the mass, or radiant heat reflected

upward from oil or gas burners in firebrick recesses between the ties.

Unloading granular or finely pulverized materials from box cars follows the old methods of the power shovel or the pneumatic conveyor; the latter having the advantage of safety and dustless operation and the slight disadvantage of requiring five times the power requirement of the other per ton handled per hour.

Outside ground storage methods have changed but little, with the exception of the trend toward a more general use of the bulldozer and carryall—the bulldozer, when the trip is not over 200 ft. out and back, and the carryall for longer hauls and larger capacities. Often the two work in cooperation. Where reserve storage is inclosed (silo storage), the routine still employs standard elevators or conveyors, or the pneumatic system.

In the Plant

Inside the plant there have been striking developments in handling and storage. Wartime operations involved the handling of spectacular volumes and the application of motorized industrial trucks was found to be so advantageous that their use multiplied as rapidly as such trucks could be secured. In a recently completed plant for which the writer acted as consultant on the materials handling scheme, it was interesting to observe that the youthful operators of motorized fork trucks developed fair skill within a week, and in a month seemed veterans at the job. This is interesting because, unlike practically all other materials handling methods (with the exception of grab bucket operations), results cannot be predicted accurately since they are directly related to the skill of available personnel.

Trucks and tractors usually are powered by storage battery and motor to eliminate the possibly objectionable carbon monoxide exhaust gas resulting from gasoline engine operation. However, the gas-mechanical truck, powered by gasoline engine and geared transmission as in an automobile, is advantageous where electric power is not convenient or where trucks are moved from point to point and cannot be kept near a charging station. They are favored too where operations involve a day or two of work, and then inactivity for a week or two, while servicing and adjustments may be made.

Palletized loads, that is, items which are stacked or piled on pallets or skids, can be handled by motorized trucks into the plant from cars, through the plant, and from the plant to cars or trucks. Not infrequently this means reduction in handling cost, compared with the old hand-truck method, by as much as 90 percent. Pallets may be stacked more readily than skids and take less head room—and they cost less. If the distances and volume of traffic are small, the inexpensive manually propelled truck may suffice, but motorized hand trucks are now available with power lift and traction. For larger capacities the operator rides the truck, which then is geared up to 600 fpm.—about the limit for safety. With extension mast the high-lift truck will stack palletized loads up to 12 ft. Various modifications have been devised. Equipped with a gooseneck and suitable grab, such a truck can load and unload rolls and barrels. It may have a tilting cradle to dump container loads into cars; stub shafts for coiled wire; a scoop for shovelling limestone, ores, etc. The variations are almost endless.

The advantage of the industrial truck is its availability for action in any part of the plant, as contrasted to a conveyor which is fixed in position and scope (range) of operations. Where quantities of materials are to be collected at one or more points and moved to other points as with less-carload freight, a tractor forms trailers into trains, transfers them to the loading points, drops them off and, after they are loaded, reassembles the trains for movement to the unloading points. One tractor suffices for several trains and is thus freed from idle time.

How Many Trucks?

Because it is impossible to predetermine accurately the number of trucks required for a plant, on account of the varying degree of skill attainable by the operators, the manufacturers always offer to cooperate by the loan of trucks and the training of prospective operators. To determine the number required we first must ascertain the best size of unit loads for the material to be handled, then the length of trip or the trips per day, plus an allowance for maneuvering and other delays. This gives us the minimum number of trucks to maintain plant operations, but there should always be one or more reserve trucks.

Planning the installation involves the layout of the charging station. With a.c. supply the charging set-up as a rule includes a rotary converter which provides an output of direct current at suitable voltage. If operations leave eight hours per day charging time, the trucks may be lined up at charging outlets. Where the batteries must be removed and replaced, benches holding several batteries each, with provision for quick interchanges, are well standardized. If operations are on two or more floors, a monorail hoist lifts or lowers the batteries in preference to moving the truck and battery. Trucks in general are provided with batteries for eight hours work at full load. A 4,000-lb. truck moving and tiering will use up 10 to 14 kwh. of battery energy in an eight-hour shift.

Inter-Floor Movement

Where the movement of material is from one floor to another, the motorized truck does not fit in too well, since it involves a platform elevator, possibly an elevator operator, and more or less awkward maneuvering. We have many alternatives—the gravity roll conveyor or the sliding belt conveyor in tandem with a tray elevator or lowerer, usually with automatic loading or discharge; or if it is a descending operation, the spiral chute. A limitation of the last named is that materials differ in "slidability;" the fast ones catch up with those which lag, and damage may result if the packages are fragile.

If the lift is on an incline there are several standardized machines, some with cradles attached to double strand chains, some with cleats attached to a belt, and the standard inclined bucket elevators.

Gravity roll conveyors are inclined downward sufficiently to insure movement by gravity. About $\frac{1}{2}$ in. per ft. will do for cartons, about $\frac{3}{4}$ in. per ft. for wood boxes not over 75 lb. each, and for heavy rigid loads, somewhat less. The rollers should be spaced so that not fewer than three are always under the box or carton. Complications enter with yielding unit loads (i.e., bags etc.) which tend to sag between adjacent rollers unless these are very closely spaced.

Tray elevators and lowerers for unit loads are favored machines for movement vertically upward or downward. When such equipment extends through several floors it is important that the inclosure or casing be of fireproof construction and the openings on each floor equipped with quick-closing cover plates actuated manually or, in emergency, by release of fusible plugs.

There seems to be little trend from these long standardized machines, which have proved entirely satisfactory when properly applied. For granular and pulverized materials where completely dustless operation is essential, and the capacity is perhaps 75 tons per hour or less, there is increasing use of the continuous flow elevator (Redler, Bulk Flo, etc.). This type of machine gives excellent service with materials not actively abrasive or cor-

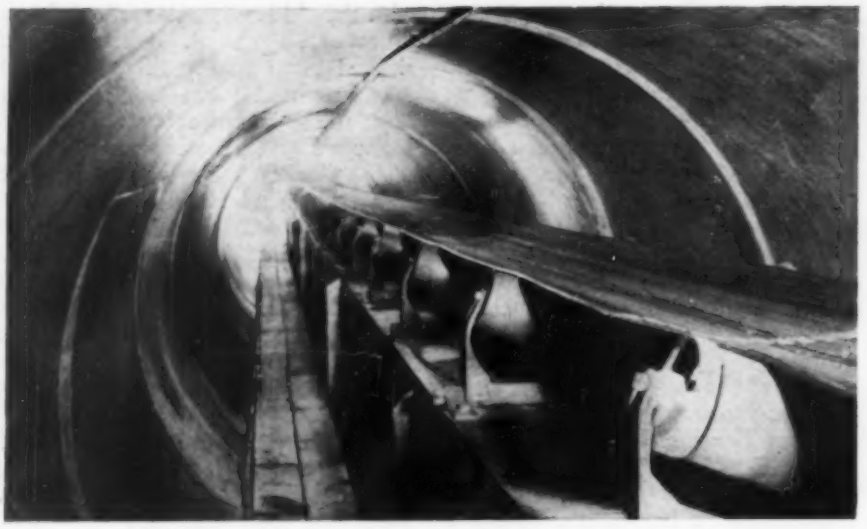
rosive. It is occasionally misapplied for a material that corrodes or cuts the walls of the duct and the embedded chain. Borax, coke breeze, molybdenum concentrates, sand, hot brewers grains containing lactic acid, damp coal with an acid content, and metallic dusts which work into and bind the chain joints, are typical of materials which usually can be handled to better advantage by the older types of equipment.

Dust Explosions

Mention should be made of the possibility of explosions originating in, or aided by, the materials handling equipment. The frequency of disastrous explosions has turned attention sharply to this factor, which too often has been disregarded in the past. This comes from the danger in floating dust from materials now coming into general use. True, the risk in grain and coal dusts has long been recognized, but mixtures of air with powdered plastics, metals, resins, wood fillers, sulphur, etc., have an explosive violence far greater. Such explosions may be caused by open flames, sparking trolleys or switches, or static sparks. The dust when ignited results in a puff that dislodges accumulations on chutes, machinery supports or ceiling beams and may provide the critical mixture with the air necessary to propagate the flame or cause detonation. The desirability of dustless operations and good housekeeping is now generally appreciated.

Any combustible material in finely divided form may produce a dust explosion if mixed with air within certain limits of saturation. In material handling installations this saturation varies from too much to too little, and somewhere may be just right for flame propagation or detonation. Typical conditions exist where the material discharges from the tripper of a belt conveyor into a bin or bunker, in the air blast of a pneumatic conveyor where a static spark may be struck, in the discharge from a crusher or hammermill where a fragment of tramp iron may strike a spark, or within a gas- or coal-burning rotary dryer for dusty material.

Safety provisions include construction which will vent or release explosive pressures, such as light weight panels, venting of chutes, dust-tight inclosures, and careful adherence to the recommendations of the National Fire Protection Association.



RAW MATERIALS, chrome ore, magnesite and olivine, enter plant by belt from crusher below receiving track.

MATERIALS HANDLING AT

Harbison-Walker Refractories Plant

Case History No. 2—

Required: In a new plant making basic refractories, handling methods that (1) prevent contamination; (2) facilitate plant housekeeping; (3) permit an ideal flowsheet.

RECEIVING TRACK, track hopper, crusher building and belt conveyors.

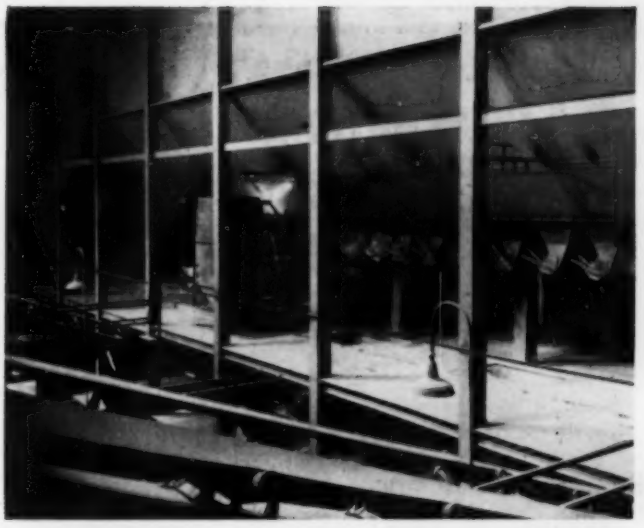
Editorial Staff

In its new basic refractories plant at Baltimore, Harbison-Walker Refractories Co., of Pittsburgh, has incorporated materials handling features which fit ideally into three basic needs. This plant, some features of which were described on pp. 120-121 of our October 1948 issue, uses chrome ore, magnesite and olivine rock, singly, or in various combinations, to produce a variety of basic refractories for steel and other high temperature industries. These include chrome, magnesite and forsterite types in both fired and chemically bonded forms, together with refractory cements and bonding mortars. The chemically bonded brick are incased in steel for some purposes, introducing still another variation.

Since three different raw materials are used, and because the control of composition is important, handling methods that will prevent any possibility of contamination are essential. Plant housekeeping is also a problem since cleanliness is needed both as an anti-contamination means, and for psychological reasons. Finally, a very considerable tonnage is handled, which means that the handling must be economical and must key well with the process requirements.

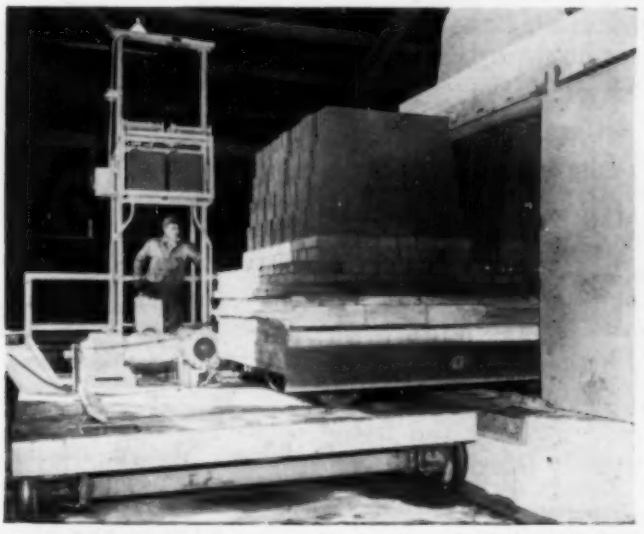
Incoming raw materials are unloaded from hopper cars by a car shake-out to an under-track hopper, dropping down to an underground feeder-grizzly where the fines pass through to a belt, while the over-size enters a 13-in. gyratory crusher, thence dropping to the same belt. The belt elevates the ore to a 36-in. cone crusher, scalping screen and small gyratory, with the crushed product

STORAGE under cover is provided for coarse-ground materials, brought in by conveyor and removed by scoop.



STORAGE BINS chute coarse-ground materials to grinding mills, and fine raw materials to a batch weighing car.

BRICK PRESSES deliver direct to kiln cars, as here, for fired brick, or to steel pallets for chemically bonded brick.



TRANSFER CARS are used at each end of the kiln to carry kiln cars from storage track to kiln, or vice versa.

carried by a succession of belts and shuttle conveyors to concrete pockets in a covered storage building. Material is then taken from the pockets as needed by powered scoop trucks and discharged to long belt conveyors if dry, or sent first through one of two oil-fired rotary dryers, if wet. From this point on the three raw materials are carefully segregated, with triple lines of storage, grinding, mixing and other equipment.

The belts from the storage building convey the dry crushed ore to shuttle conveyors and then to bins from which, as needed, the ore is chuted to dry pans or ball mills. Bucket elevators take the ground materials up to triple screening units which segregate the various particle sizes, which are then chuted to shuttle conveyors for discharge to ground material storage bins. Dust collection equipment is incorporated at every point. For batching, the bins discharge by gravity, aided by bin vibrators, to a weigh hopper lorry car, also equipped with a dust collector. Materials are carried by three elevating belts to hoppers over the nine mixers where a slightly moist mixture is produced by adding bonding materials and water. The mixers, which are self-discharging, deliver by gravity to the 300- and 500-ton brick presses.

Enter the Fork Truck

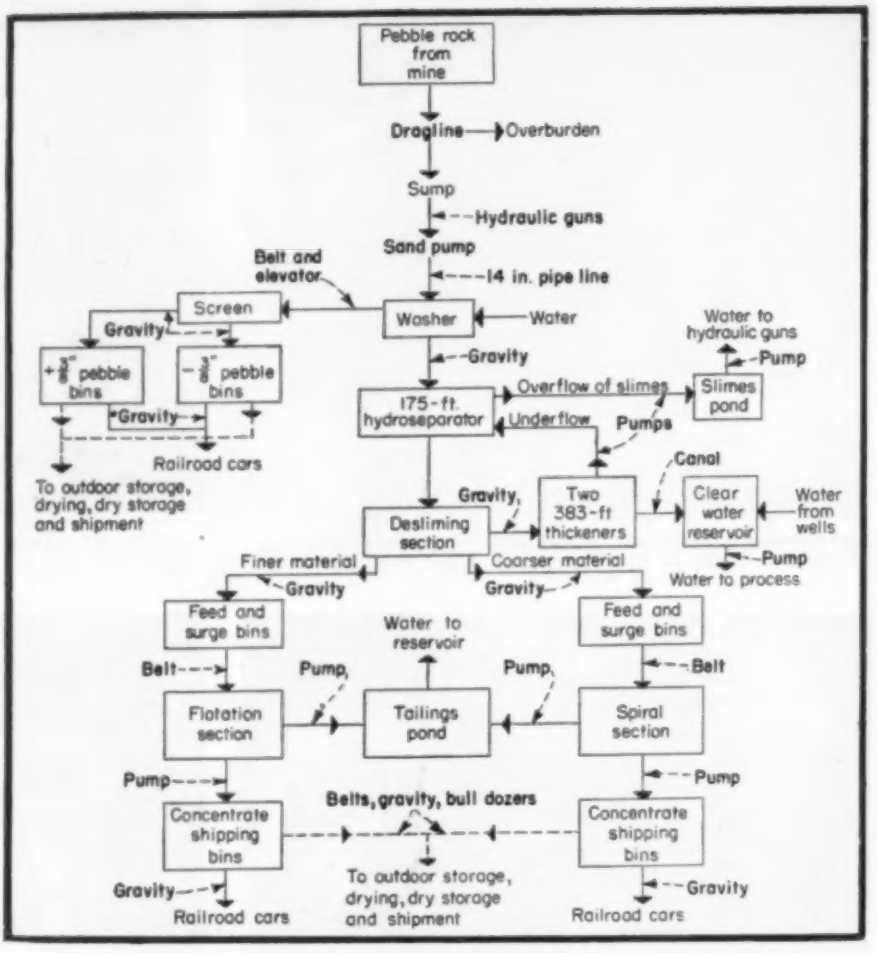
Once the brick are formed, all handling is either on pallets or on kiln cars. Except for metal-cased brick, all brick are taken manually from the presses and loaded on to metal pallets (for the chemically bonded brick), or on to kiln cars (for brick to be fired). Metal-cased brick are taken from the press, inserted manually into metal cases which are sprung apart by an ingenious magnetic device, then loaded on to pallets. The pallets of chemically bonded brick are picked up by fork trucks, placed on dryer cars and pushed into the dryer by the fork trucks. Brick to be fired are dried on kiln cars in their own dryer, moved on to storage tracks by an electric tractor, then are fed into the kiln by a transfer car and hydraulic pusher. When cars are removed from the kiln they are pulled out on to a transfer car by a power capstan, then transferred to cooling tracks. Cooled brick are inspected and unloaded manually to wooden pallets for storage and eventual transfer to the railroad cars in which they are to be shipped. Chemically bonded brick are similarly inspected, unloaded from the metal pallets to wooden ones, and carried to storage and eventual shipping.

MATERIALS HANDLING AT

International Minerals' Noralyn Phosphate Plant

Case History No. 2—

Required: In a process involving mining, processing and shipment of a single raw material on a very large scale, materials handling that (1) fits cleanly into the process flowsheet; (2) moves the material through many operations on a tonnage basis at lowest possible cost per ton.



MAIN STEPS in Noralyn's handling of phosphate rock appear here.

Theodore R. Olive
Associate Editor,
Chemical Engineering

LARGEST phosphate operation in the world, the Noralyn mine, washer and concentrating plant of International Minerals & Chemical Corp., Chicago, went into operation near Bartow, in the Florida land pebble phosphate field, early this past summer. Because the plant product is a solid, turned out at the tremendous rate of 4,000 long tons or more per day, and because solids must be moved efficiently through every one of the many steps in the process, it is particularly interesting to examine the overall operations from mine to rail cars in the light of the materials handling methods used.

First, to set the stage, it is necessary to cite the main statistics of the operation and some of the facts bearing on it. Phosphate rock producers in the central Florida land pebble area number eight, and their combined output is over 40 percent of total world production. Of these, International is by far the largest shipper, with its three mines at Achan, Peace Valley and Noralyn. Florida produces more than five times the output of Tennessee, the next largest producing state. International's Florida share of the total is now rated at some 3,500,000 long tons of output per year, of which 1,500,000 tons will come from Noralyn.

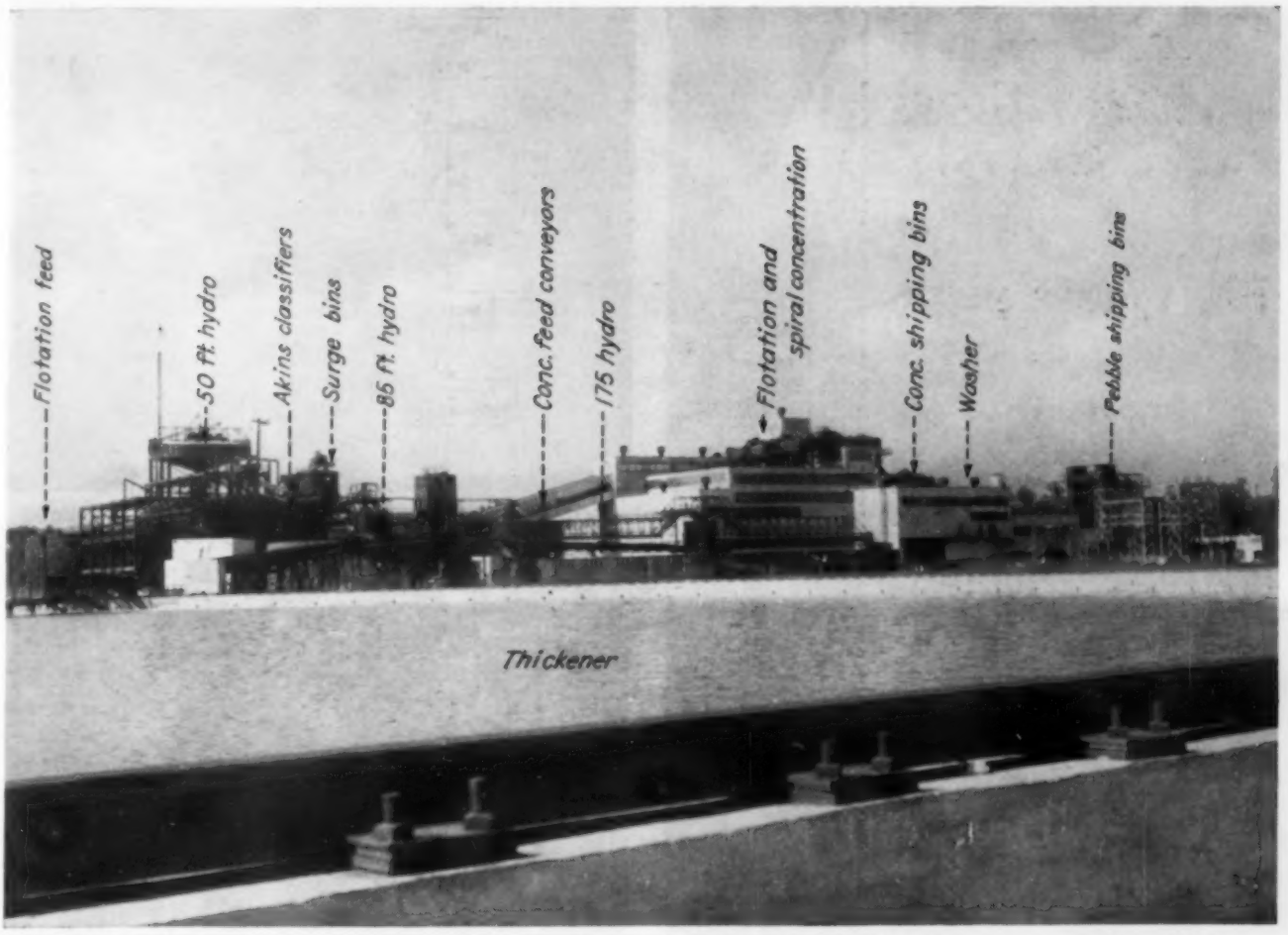
Division of Responsibility

The Noralyn project under the general direction of Louis Ware, president, is operated by the Phosphate Division under Franklin Farley, vice president, at Chicago, and R. B. Fuller, who is manager at Mulberry, Fla. Process design from inception to pilot operations was carried out by the Research Division under Dr. Paul D. V. Manning, vice-president, and Dr. I. M. LeBaron, in charge of phosphate research. Engineering design and construction of the new plant were headed by J. A. Barr, International's chief engineer, under supervision of R. B. Fuller, with Lawrence Frye as project engineer and Turner Loehr (now chief engineer of the Florida Phosphate Division) in charge of electrical installation.

The concentrating plant at Noralyn is situated in a 2,000-acre tract of high grade phosphate land about 3½ miles south of Bartow. The phosphate beds, containing a supply estimated to last over 25 years, lie under an overburden layer averaging 15 ft. in thickness and consist of a 15 to 20 ft. thick layer of pebble phosphate, embedded in a matrix of clay and sand. To produce at rated capacity, about 120 acres will be mined per year, involving the movement of some 6,000,000 cu.yd. of matrix and overburden, or close to 9,000,000 long tons. About one-half of this huge annual total is pumped to the plant.

What Plant Produces

The plant and mine involve an investment of about $10,000,000. The output, averaging about 77 percent bone phosphate of lime (b.p.l.), represents a 92 percent recovery of values in the plant feed and consists of about 500 tons per day of washer pebble and 3,500 tons per day of concentrates. About 10 percent of the pebble, which runs 72 to 74 percent b.p.l., is plus ⅜ in. and is separated for electric furnace feed. The concentrates, running 77-78 percent b.p.l., are produced by two processes, flotation and concen-



MAIN BUILDINGS and other structures of the Noralyn plant are identified in this view across one of the thickeners.

tration in Humphreys spirals, with about 3,000 tons per day from the flotation cells and 500 tons per day from the spirals.

Plant's Liquid Load

Water supply and waste disposal constitute first magnitude problems for a plant of this type. Noralyn consumes about 40,000 gpm. of clear water which is provided by three deep-well pumps and by clear water returns from the process. Including recirculation, the combined capacity of all pumps is about 150,000,000 gpd. To dispose of the enormous load of slimes and tailings the operation makes use of two settling ponds totalling nearly 600 acres in area, while the plant alone covers about 9 acres. The two 383-ft. thickeners used to return 15,000-20,000 gpm. of clear water to the plant reservoir are currently the world's largest. Clear water is also recovered from the tailings pond. Some 4,000 gpm. is pumped from the slimes pond for sluicing matrix at the mine. With so much water recovery, a single well can generally supply the deficit.

By way of a quick summary of the entire operation, matrix (consisting of 50-60 percent phosphate rock, 10-25 percent sand, and 15-40 percent clay) is mined by a walking dragline excavator and sluiced to the intake of a pump which transports the material in suspension to the head of the washer. The washer makes the first separation into two particle sizes, elevating the larger to pebble phosphate shipping bins and sending the smaller to the desliming section. The desliming section rejects the minus 200 mesh material (mainly clay), recovers as much process water as possible, and separates the remaining solids into two portions, the smaller mesh material going to the flotation cells, and the larger to the spiral concentrators. At present the three main divisions of the product, pebble, flotation concentrates, and spiral concentrates, are shipped by rail to nearby Mulberry where they are stored, dried, blended, ground if necessary, and shipped to users. Construction is now nearly completed at Noralyn which will permit the large-scale storage of wet material and the shipping of dry material direct from that plant, without intermediate handling to Mulberry.

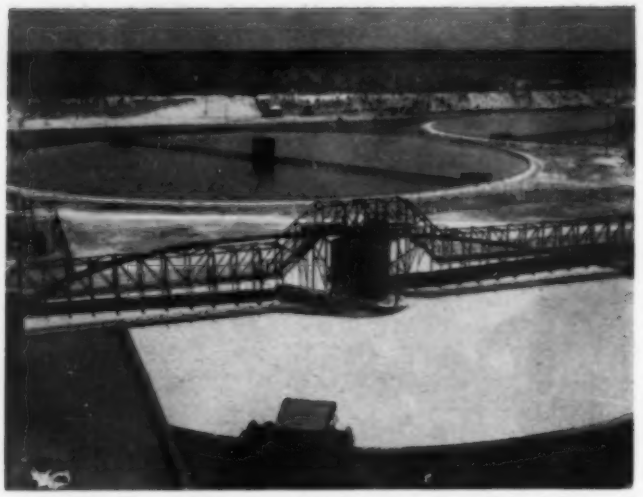
Materials Handling

The underlying idea in materials handling at Noralyn is to use, so far as possible, methods which fit directly into the process flowsheet. Since all of the processing is wet and is conducted in the presence of large quantities of water, pumping of the solids in suspension, or their flow by gravity, are the main materials handling methods used, supplemented by troughed, rubber-covered belt conveyors. At Mulberry locomotive cranes and bulldozers are used for outdoor storage, while belts, bucket elevators, screw and pneumatic conveyors and gravity flow complete the picture. Belts, bulldozers and gravity flow will handle product storage, drying and shipping at Noralyn. Most of the processing equipment inherently incorporates materials handling features as would be expected in a flow sheet comprising an excavator, screens, classifiers, hydroseparators and thickeners, flotation cells and spiral concentrators.

Mining the Matrix

Stripping of the overburden, which is deposited to one side, and mining

DRAGLINE "Tillie-the-Toiler" scoops up over 25 tons of matrix per bite, dropping it near the suction of the pump.



HYDROSEPARATOR 175 ft. in diameter overflows slimes to the slime pond. Clear water thickeners appear beyond.

WASHER'S three parallel lines of screens and washing equipment separate matrix into coarser and finer sizes.

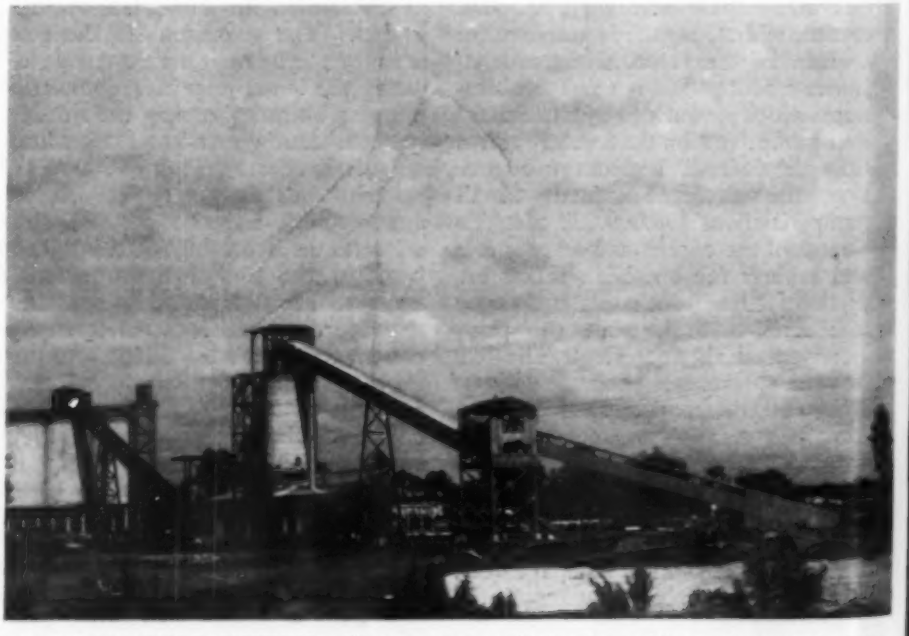
AKINS CLASSIFIERS, aided by trommels, help to de-slime washer "debris," size residue for cells and spirals.

of the matrix, are accomplished by "Tillie-the-Toiler," a 16-cu.yd. walking dragline excavator which is operated electrically by variable-speed d.c. motors.

Power for the seven driving motors, provided through a heavy cable, comes in at 4,000 volts a.c. and is converted by motor-generator sets aboard the excavator. "Tillie," although smaller than the 21 cu.yd. "Bigger Digger" at the Peace Valley mine (*Chem. Eng.*, Aug. 1947, p. 116), can still reach out about 168 ft. with her 175-ft. boom and can scoop up a load of well over 50,000 lb. at a bite. She can dump at a height of 75 ft. and is one of the largest dragline excavators in the non-metallic field.

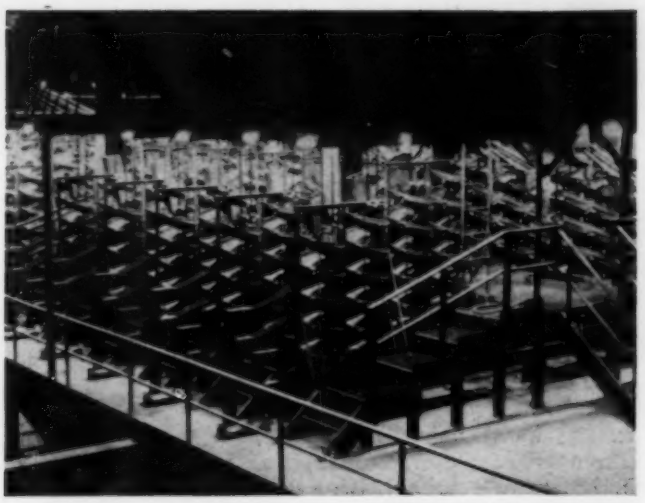
Pumping to the Plant

The excavator pivots on its 40-ft. diameter base to drop its load of matrix at the edge of the pump suction pit.

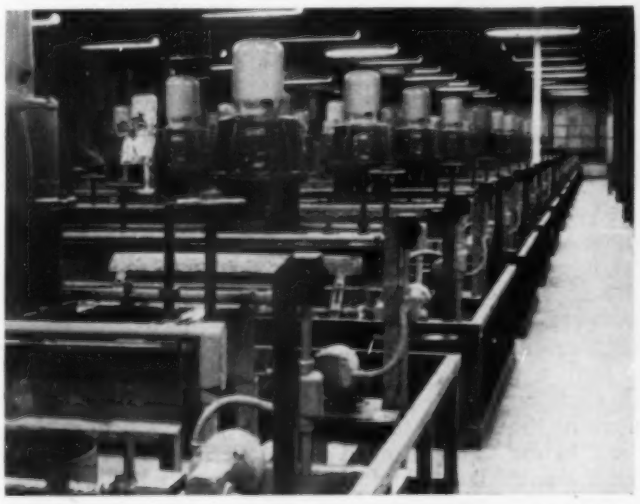


NEW CONVEYOR SYSTEM will carry concentrates to outdoor storage at right.

SLOPING CONVEYORS elevate feed from storage tanks and surge bins to level above flotation cells and spirals.

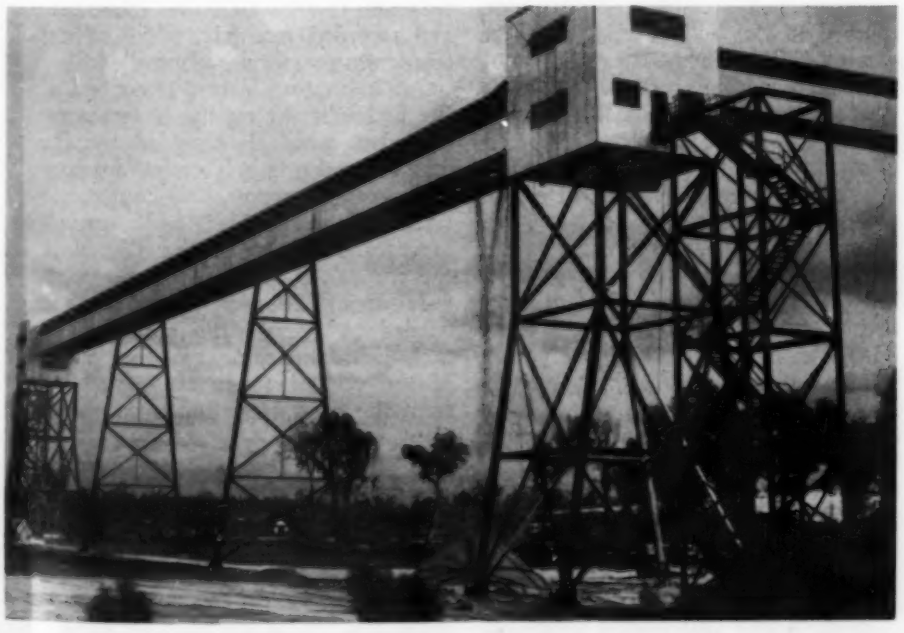


HUMPHREYS SPIRALS serve to concentrate coarser phosphate rock particles than those treated by flotation.



FLOTATION CELLS are used in an efficient double-float circuit for separating sands from phosphate concentrates.

SHIPPING BINS for wet phosphate concentrates load cars for transport to dryers and pulverizers at Mulberry.



then to rotary dryer building and shipping bins at extreme left-hand side of view.

Or, when it must be moved, it picks up and puts down its 7x40 ft. shoes and walks to the new location. Three men near the pump suction direct streams from hydraulic guns or monitors and sluice the matrix into the suction pit, the three guns being supplied with 4,000-5,000 gpm. of water from a 500-hp., 200-ft. head pump through a 14-in. line. A 12-in. sand pump driven by a 300-hp. motor picks up the slurry of matrix and transports it about ¼ mile through a 14-in. line in which are two comparable booster pumps. Its destination is the feed box which is located at the top of the washer.

Movable Mining

Since mining operations must move from time to time, the 14-in. spiral-welded steel pipes for hydraulic water and matrix are flanged and bolted for ready relocation and the pump houses, complete with electrical gear, are

mounted on skids to be dragged by tractor to the new situation.

Matrix Washing

The washer splits the plant feed into two ranges of size, segregating the larger particles for shipment as pebble without further concentration. Its three identical, parallel units operate mainly by gravity flow, each unit consisting of a sequence of screens and washers sprayed with water, as follows: Feed box, gravity screen, rotating trommel, double-deck vibrating screen, 20-ft. log washer, single-deck vibrating screen, 30-ft. log washer and single-deck vibrating screen. The oversize from the double-deck screen in each line is carried by belt to two hammer mills which reduce it below ½ in. The hammer mill product, the undersize from each screen except the first, and the overflow from the log washers all drop to the washer "debris" sump and the mixture is pumped back to the feed box at the head end. All material passing through the first, or gravity, screen flows to a 175-ft. hydroseparator in the desliming section. Material passing over the final screen is lifted by bucket elevator to final screens above the pebble shipping bins where the plus ⅜ in. pebble is segregated for shipment to electric furnace customers. The two elevators serve the two outer washer lines directly. A reversible belt takes the product from the central line and delivers to either elevator at will.

Desliming Section

Three important functions are carried out by the desliming section including: (1) Separation and rejection of the minus 200 mesh slimes; (2) recovery of clear water for further use; and (3) separation of the remaining solids into two size fractions for flotation and Humphreys spiral feed. These operations are accomplished mainly by a group of three hydroseparators of 175, 85 and 50 ft. diameter, working in conjunction with two 383-ft. thickeners and five Akins duplex spiral classifiers in parallel, each being in series with a sequence of two water-sprayed, fine-mesh trommels.

The underflow from the washer flows to the 175-ft. hydroseparator which, in its function as a 200-mesh sieve, overflows slimes of minus 200 mesh to the slimes pond. The classifiers overflow fines and the bulk of the remaining slimes to the 85-ft. hydroseparator, which in turn overflows to the two big thickeners and underflows to the 50-ft. hydroseparator. The latter is high in the air above the flotation feed bins. The Akins rake product is split in the five series of trommels, with the finer part going to the flotation feed bins by way of the 50-ft. hydroseparator, and the remainder going direct to the spiral feed bins. All handling in this section is either by pump or by gravity. Most overflows are routed to the 85-ft. hydroseparator, their water going thence to the thickeners and their solids to the 175-ft. hydroseparator. All clear water is overflowed by the two thickeners, and all slimes leave for the slime pond via the 175-ft. hydro.

Feed from the flotation feed bins is pumped to surge bins, then drops to a sextuple-rake bowl classifier which dewaters and delivers it by belt conveyor to the flotation section. Spiral feed is also passed through a surge bin, dewatered by a rake classifier, and delivered by belt to the spiral section.

Flotation Concentration

Flotation feed, being the finer of the two fractions produced by the desliming section, contains not only sand, in addition to phosphate, but also a small remaining quantity of clay. A double float is used, as at the company's Peace Valley plant, first floating the rock away from the sand and then, through use of a different reagent, floating the remaining sand away from the rock concentrate. In the first circuit the feed is treated with a reagent which coats and permits bubble attachment to the phosphate particles, but not to the sand. The circuit is a complex one employing flotation cells of the sub-aeration type, from which the tailings are segregated in a 30-ft. hydroseparator and passed through scavenger cells for recovery of small quantities of phosphate trapped in the bulk of the sand. At various stages hydroseparators and rake classifiers are used to dewater the feeds to the various cell banks.

The recleaned concentrate is treated to remove the residual reagent, then retreated with an amine reagent which coats and floats the sand but not the phosphate. After passage through the final bank of amine cells, the concentrate is partially dewatered in a 30-ft. hydroseparator, then pumped to a bowl classifier atop the concentrate shipping bins where further dewatering takes place. Slimes are removed to the slimes pond from the various hydroseparators and the tailings from the flotation section leave from the scavenger cells and flow to a tailings pond.

Spiral Concentration

Noralyn uses Humphreys spirals for the concentration of the coarser part of the material, instead of the concentrating tables used for the same purpose at the Peace Valley plant. International developed this and is the first to use spirals in the phosphate industry, finding an advantage of considerable space saving and lower maintenance as compared with tables.

The principle of operation is somewhat obscure (see *Chem. & Met.*, Apr. 1945, p. 107) but it can be pointed out, in brief, that a mixture of solids of various apparent specific gravities suspended in liquid will segregate in flowing down the spiral path in such a way that the heaviest solids seek the inside path, the lightest an outside path, and those of intermediate densities, an intermediate path. The separation is aided by applying wash water at intervals to the inner edge of the path, and skimming the heaviest solids at frequent intervals. With phosphate rock the phosphate concentrate goes to the outside, the denser sand to the inside. The concentrates are pumped to a rake classifier atop the concentrate shipping bins, partially dewatered and dropped to the bins.

Process Control

An unusual amount of automatic control is employed for a plant of the type described here, with numerous automatic and remote indicating instruments centralized in a control room in the flotation building. Plant feed and various pump speeds are controlled automatically, as are classifier and hydroseparator underflow and overflow densities at many points. Flotation and spiral feeds are weighed and recorded remotely by Weightometers on the feed belts. Flow of all reagents is measured by rotameters and recorded remotely, while critical temperatures are also controlled.

An interesting feature is control of the hydraulic lift on the hydroseparator rakes, which is provided to take care of overloading. To allow for contingencies, however, all automatic controls are provided with manual bypasses. Evidence of the efficacy of the controls is found in the fact that only about 20 men per shift are needed to operate the entire plant, exclusive of the mine, and that much of the operation can be carried on from the central control room of the plant.

Drying and Grinding

At present the plant output is carried in hopper railroad cars to Mulberry for wet storage, drying, grinding if necessary, dry storage, and shipment. Cars reach the plant on an out-

(*Continued on page* 106)

MATERIALS HANDLING AT

Merck's Fine Chemicals Plant

Case History No. 3—

Required: In production of a very large number of fine chemicals and pharmaceuticals, methods for handling materials that will fit (1) small quantities; (2) tremendous diversity; (3) and will avert any possibility of contamination or the switching of containers.

ORDERS for finished products of many types are assembled expeditiously by the use of "scooters." Stock handlers transfer their loads to monorails.

Editorial Staff

(Other articles in this series have dealt with plants making a relatively small number of products that are handled in from very large to moderate tonnages. The present article is concerned with the other extreme—a plant making over 1,300 different products, most of which are handled in small quantities and are shipped in several different sizes of container. In the final stages 11,442 items must be handled, including different sizes, which brings out totally different problems.—Editor.)

AT ITS main plant at Rahway, N. J., where fine chemicals, pharmaceuticals and anti-biotics are made, Merck & Co., Inc., has a materials handling problem of tremendous diversity. This is one of the principal jobs assigned to the industrial engineering section of the company's central engineering department. These engineers are constantly faced with such problems as: (1) Can handling be improved; (2) will the improvement really pay; (3) will the improvement adversely affect necessary flexibility of a plant in which various sections are constantly being modified for new products or processes; and (4) may it be possible for the proposed handling method to introduce a hazard such as the accidental switching of containers or packages? This last consideration is particularly important to a manufacturer of pharmaceutical chemicals.

Most liquids arrive at the plant either in tank cars or in metal drums or carboys. Most solids are received in bags, barrels or fiber drums. Tank cars are unloaded by conventional methods, with flammable liquids such as solvents stored in underground tank farms, of which there are several at various points in the plant. So far as possible, the unloading and warehousing of incoming solids and containers are accomplished by fork truck, with the materials either received on pallets, or stacked on the plant's own pallets at the cars. Warehouses, as well as most other factory buildings, are of heavy mill construction and provide a clear height sufficient to permit most pallet loads to be stacked four high through the use of high-lift trucks.

RAW MATERIALS so far as possible are unloaded and stored on pallets by means of fork trucks. About 20 electric trucks are in use in the plant.

Industrial Trucks

Electric industrial trucks are the work horses of the plant. About 20 are in constant use, including both low- and high-lift platform trucks, as well as high-lift fork trucks. Battery recharging is handled at a central recharging station, equipped with three motor-generator sets. As the load becomes heavier, it is contemplated that spare batteries will be provided to permit full time use of charging equipment, but at present this is not necessary.

Despite the effort to use fork trucks and pallets as extensively as possible, this method fails in certain cases where the quantities handled are not large enough for a complete unit load. A typical example that often occurs is where it is necessary to withdraw only a part of a pallet load from stock, for example, one or two fiber drums from a pallet holding four. This often results in producing unstable loads for both the portion withdrawn and the part remaining. One method used for such partial loads is to withdraw the material by high-lift platform trucks, using the platform as an elevator. If the remaining load would be unstable, it is taken from the pallet and piled on wooden stringers laid on the concrete warehouse floor, or it may be piled on special metal shelves, as later described.

Although an effort is being made to substitute fork trucks as extensively

as possible for platform trucks, the latter are still widely used and have, in fact, advantages for some purposes. For example, skids are higher from the floor than pallets and are therefore a more convenient device from the receiver's standpoint, on which to take deliveries to processing departments. Likewise, and since the plant makes few shipments on pallets, skids are largely used in the shipping department for assembling loads of outgoing packages and for transporting them to cars or trucks.

As far as possible, operating departments using solid raw materials are set up in such a way that either skid or pallet loads can be brought in and lifted to the operating level by the electric truck. Considerable rehandling is thus eliminated and in some cases other materials handling devices such as elevators or conveyors thus become unnecessary.

Full advantage of the high-stacking ability of electric trucks is taken in several departments where non-palletized loads must be stored. For single containers of dry chemicals, some of which weigh as much as 400 or 500 lb., the engineering department designed a four-high metal shelf consisting of a row of vertical steel columns braced to the building at the top and supporting thoroughly braced flat steel shelves which extend outward on either side of the row of columns in cantilever fashion. Fiber drums and boxes stored here are handled by high-lift platform trucks, the technique being to slide the container from the platform to the smooth metal shelf, or from shelf to platform. A somewhat similar four-high cantilever arrangement, with lengthwise rails instead of shelves, is used in storing metal drums on their sides.

Packaging Problems

The extreme diversity of the products handled is well exemplified in the dry packaging and the shipping departments. In neither are conventional materials handling methods suitable for most operations. In dry packaging the work is divided into three sections, depending on the magnitude of the job to be done. For handling the longest runs, all operations are carried out mechanically with materials delivered to a mezzanine above the packing machines by fork or platform truck, followed by mechanical packaging and conveying past the inspectors and to the labeling machines. For runs of intermediate length weighing is manual, followed by an inspection belt and automatic labeler. For the smallest runs, however, all operations of weighing, inspection and labeling are manual. Such work has been much facilitated by the use of caster-mounted steel shelf trucks which are the same height as the weigh bench and can easily be moved to the weighing operator, inspector and labeler, and thence to storage.

Assembling Orders

Shipping has similarly been developed around the problems brought by extreme diversity. The most novel arrangements are found in the method of assembling materials called for by each order. Since the stock handlers may have to cover several hundred feet in assembling a single order, they are provided with light trucks which effectively combine features of the supermarket buggy and the juvenile scooter. By riding on the low platform and pushing with one foot these men are able to multiply normal assembly speed by a factor estimated to be at least two.

Scooter loads are transferred to monorail carriers, some of which are designated for express, and some for normal service. The carriers pass to checkers, thence to a specialist in selecting the best kind and size of packing cases for each order, then to packers and finally, by roll conveyor, to the man who attaches the shipping label, weighs the package and stacks it on a skid to await the lift truck which will carry it to the platform for loading on cars or motor trucks.

Noralyn

Continued from page 104

door trestle and drop their contents to the 12-acre storage area where the various products are segregated and piled by means of locomotive cranes and bulldozers. For reclaiming from the wet storage the rock is pushed by the bulldozers into chutes beneath the trestle, leading to either of two 30-in. belts, each about 500 ft. long and running in underground concrete tunnels. These feed to two shorter belts which discharge to bucket elevators. The elevators convey to feed bins from which the rock drops to four large oil-fired, parallel-flow rotary dryers ranging from 6 x 60 to 7½ x 80 ft. in size and from 70 to 120 tons per hour in capacity. Hot material belts of rubber, with an asbestos insert, take dried material at 160 to 180 deg. F. to bucket elevators for conveying to the indoor dry material bins.

Indoor Storage

Above the storage bins, of 30,000 tons total capacity, the rock is distributed by under-roof belts to three 150-ton per hour shuttle belt conveyors and thence to any of the bins; or to feed bins for the five ring-and-roller type air-separation pulverizers used in producing ground rock. Screw conveyors carry the pulverizer product to storage.

For shipment, cars are run directly beneath the bins and loaded by chute, either directly in case of hopper and gondola cars, or through the intermediacy of a centrifugal slinger, for box cars.

Completing Noralyn

Construction which probably will be completed at Noralyn before this article appears will make it unnecessary to transport the product to Mulberry unless it must be ground. An additional $1,300,000 investment will permit concentrates to be carried to an outdoor storage area capable of handling 101,000 tons, from which the material can be reclaimed, dried in an 80-ft., 165-ton per hour oil-fired rotary dryer and elevated to reinforced concrete shipping bins of 10,000 tons capacity. An inclined, neoprene-covered belt elevates the concentrates to a high conveyor bridge above the storage area where a second belt equipped with a tripper discharges to any selected point. The combined length of the two conveyors is 1,120 ft.

Bulldozers will be used to distribute and reclaim the stored material, with reclaiming (as at Mulberry) by means of chutes feeding an underground belt some 500 ft. long which runs in a tunnel beneath the conveyor bridge. A fourth belt elevates to the 1,400-ton reinforced concrete feed bin for the dryer. Material will be dried from 12 or 14 percent down to about 2 percent moisture and will then be elevated by a heat resistant belt to shuttle conveyors feeding the shipping bins. From these up to nine cars can be loaded simultaneously. Including the shuttle conveyors, the dry material belt totals 412 ft. in length and the combined travel on all the new belts, from plant to shipping bins, amounts to over half a mile, or nearly 2,800 ft.

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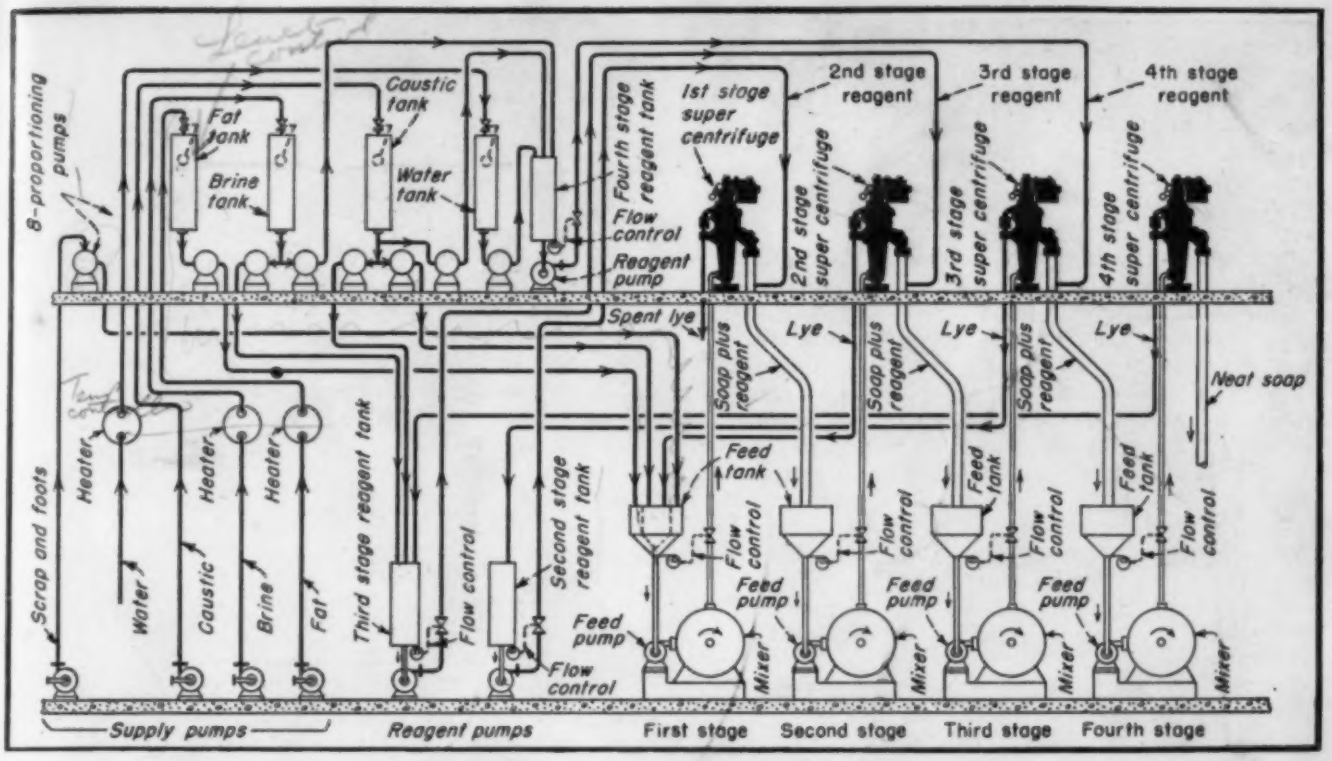


Continuous centrifuges separate soap and spent lye in this . . .

New Soap Process

Editorial Staff Resume

SOAPMAKERS have long looked for a continuous process for producing soap from fat without the necessity for high pressure hydrolysis. The latter is all right but is not particularly adapted to small plants. Now Sharples has come along with a continuous process based on the separation of lye and caustic solution from neat soap by use of a centrifuge.

The process engineered by Sharples is adaptable, so far, to plants ranging from 1,500 to 13,500 lb. of fat an hour. One plant, that of Lever Brothers, has been in operation at Baltimore for several years proving out the process. Several commercial units are in operation abroad.

Basically the process, shown in the above diagram, consists of countercurrent contacting of fat with caustic and spent lye. The countercurrent aspect results in better caustic utilization and higher glycerine recovery. The continuous operation means lower operating costs and lower steam demand. So far, Sharples has not disclosed the relationship between the capital costs of its process and conventional kettle plants.

The process begins by proportioning the raw fat, spent lye, and 50 percent caustic into a mixer. This mixer, operating continuously, gives a 98 percent saponification of the raw fat. The lye, on the other hand, is reduced to less than 0.1 percent free Na_2O content since it is reacting with unsaponified fat. The mixture of saponified fat and spent lye from the mixer then is passed through a continuous centrifuge to separate the two materials. Spent lye from the centrifuge may then be sent to glycerine recovery.

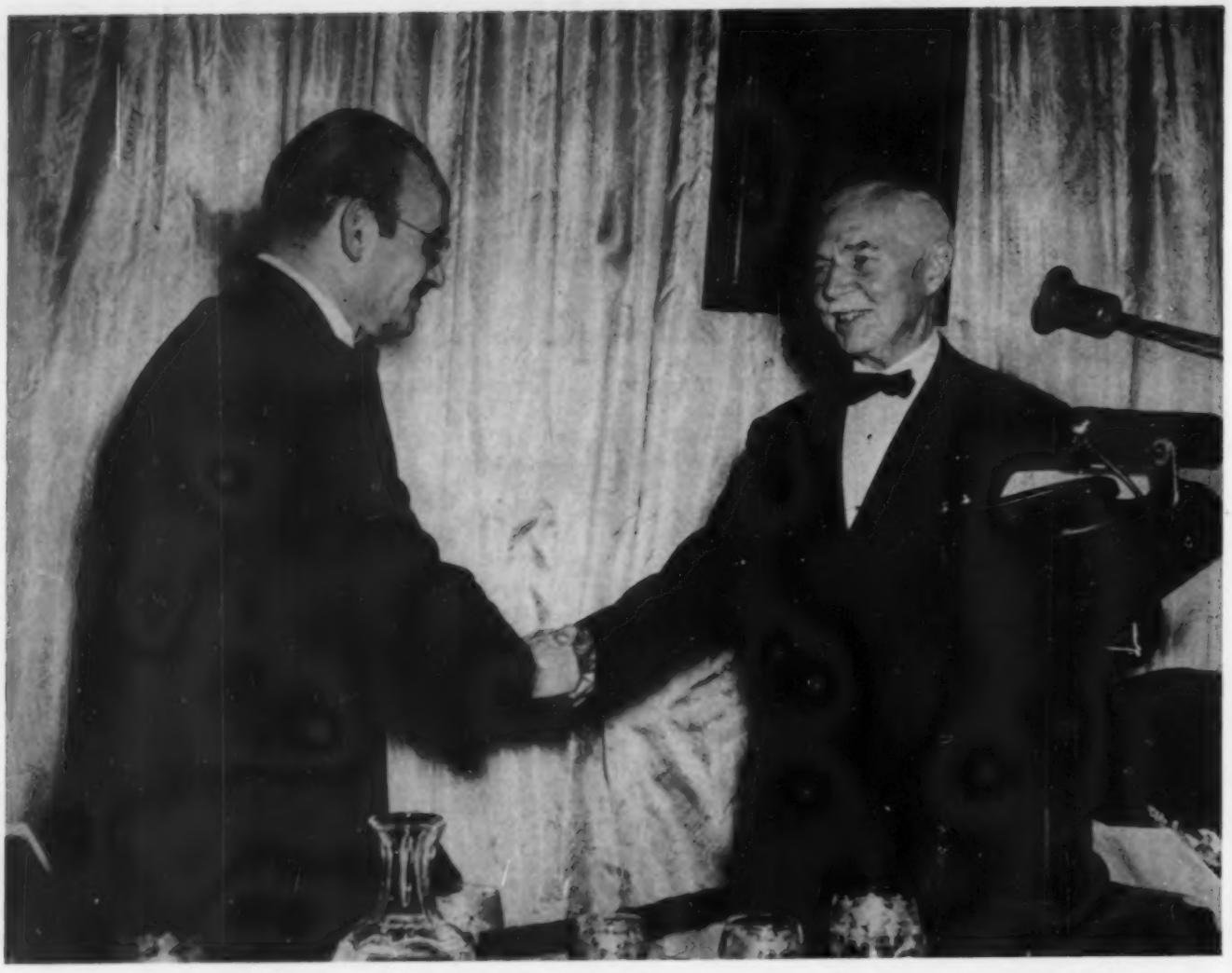
In the second step in the process the fat is completely saponified by reaction with spent lye from the third stage in the process. Since the lye contains caustic in excess of the amount needed to complete the saponification, the reaction goes to completion. In a manner exactly analagous to the first step, spent lye and soap are separated in a high speed centrifuge.

The third and fourth steps are analagous to the first two. Each consists of mixing the saponified fat with spent lye from the next further step, fresh caustic, and brine. In the last step, there is no spent lye and the mixing is with fresh caustic and brine. The third step serves to wash out the glycerine and salt from the saponified fat, and the fourth step separates the colored nigre. Because of the recycling, no nigre is produced by the process and the entire output is neat soap, together with the glycerine-spent lye.

Success of the process has been due to the use of highly efficient centrifuges which develop a force of 13,200 times gravity. A new type of proportioning pump was developed for the process. This pump, air operated, is a double cylinder, positive displacement pump. The cylinder diameters of the pumps supplying the various ingredients are varied to give approximately the proper proportions. Final adjustment is made by varying the stroke. The entire process is governed by automatic control so that operating personnel requirements are held to a minimum. One operator can handle the smaller plants, and only two men are required for the larger units.

Utility requirements for the process vary with size. Electric power load varies from 0.022 to 0.01 kwh. per lb. fat processed. Steam used is standard at 0.17 lb. per lb. fat for all sized plants. Compressed air load varies from 1.2 to 0.4 cu. ft. per lb. fat and is needed at 40 psig.

Advantages claimed for the process include a more uniform soap, lower operating costs, lower steam consumption, a better yield of glycerine, and more soap per pound of fat because of the elimination of nigre. The process operates on any fat formulation normally used by soap manufacturers.



Antoine E. Lacomblé, on behalf of Shell Development Co., receives the 1948 Award for Chemical Engineering Achievement from Alfred E. White. The bronze plaque above Professor White's head commemorates the event.

Rewarding Group Effort and Teamwork

Shell Development Company's successful synthesis of glycerine — voted 1948's *outstanding achievement in chemical engineering — was duly celebrated by* 700 *members of the profession and their guests at an impressive dinner in New York's Waldorf-Astoria on November* 10. *Chairman Alfred H. White of the Committee of Award presented an appropriate bronze plaque to President Antoine E. Lacomblé of Shell Development Co. and President Alexander Fraser of Shell Union Oil Corp. Excerpts from their addresses are presented on the pages which follow.*

Presentation of Award

ALFRED H. WHITE
Chairman, Committee of Award
Professor Emeritus, Chemical Engineering, University of Michigan

WHEN I remember the organic chemistry which was taught 50 or even 25 years ago and consider, in that light, the transformations which chemical engineers are performing as the molecules "float through the air with the greatest of ease," I am strongly tempted to agree with the old backwoodsman who, when he saw the elephant, said, "I still maintain there ain't no such beast."

The Committee of Award has not been so skeptical as that old man, but it has been so appreciative of the difficulties surmounted and so enthusiastic over the results attained that it has, by a very large majority of its fifty-two members agreed upon the outstanding development to receive this year's award.

The company to which this award is made has a high record of success in other important projects. The achievement which is honored tonight is the development from laboratory synthesis to successful plant operation of a process for converting petroleum hydrocarbons into glycerine, thus giving our country the assurance of an economical and an almost unlimited supply of this important material.

It is a privilege and a pleasure to present, on behalf of the Committee of Award, the 1948 Award for Chemical Engineering Achievement to the Shell Development Company.

Acceptance of Award

ANTOINE E. LACOMBLÉ
President, Shell Development Company

CHEMICAL engineering achievement must be measured finally in terms of a manufacturing facility which contributes to the economic prosperity of the nation. A research and development company, such as ours, therefore, requires the confidence and support of its manufacturing associates. Our Shell affiliates, the Shell Oil Co. and the Shell Chemical Corp., by technical cooperation and by their installation of new facilities, such as the synthetic glycerine plant, have brought our research and development activities to full fruition, and we hereby extend them our sincere thanks.

Next, we, as members of the chemical process industries, owe a debt of gratitude to the educators in this country, those in the fields of basic science, and particularly those in the field of chemical engineering. That America today occupies the world position it does, is due in no small part to the thoroughness, boldness, and vision of the chemical engineering training in our colleges.

We in Shell have tried to take full advantage of the opportunity granted us by the availability of young chemical engineers. Over the last twenty years we have gradually built up in our plants, in our head offices and in Shell Development Co., centers of chemical engineering skill which have shown themselves capable of handling their important tasks and on whom we can confidently rely for solving the problems of the future.

When the secretary of the committee announced that the 1948 award had been made to Shell Development, he stated that our "postwar program was based on exactly the sort of coordinated group effort which this award was designed to recognize and encourage in the chemical process industries."

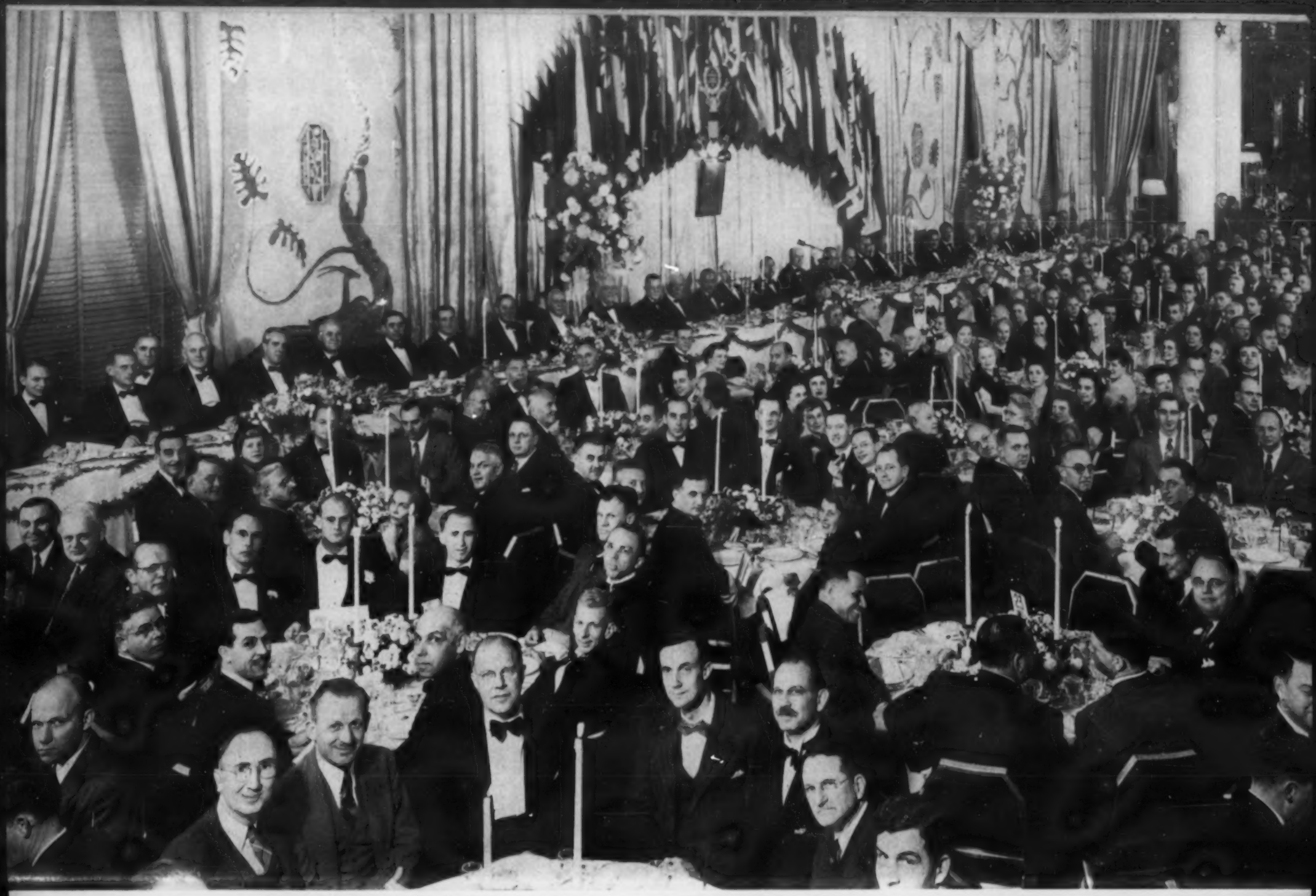
I may, therefore, be justified in addressing a few words about our practices regarding such coordinated efforts and about the philosophy which underlies them.

The relations between the groups of organic and physical chemists, process chemists, process and mechanical engineers, are based on voluntary but critical acceptance of each other's competence in his designated field. This, I think, is what is usually meant by "teamwork." Organizationally speaking, it is cooperation and contact on one level, rather than the usual family-tree type of organization. From the members of the team this method of working together demands restriction of two natural inclinations. The one, the desire to have a finger in every pie, if freely indulged in, leads to chaos. The other, more common to the older members of an organization, is the tendency to stick to a strictly defined and prescribed field of responsibility. On this procedure an organization could, in theory, be built. The result, however, to use a parallel, would resemble a masonry structure without mortar. Such structures exist and are known to have endured for centuries, but the one essential feature always is that the building blocks have been fitted together with most meticulous care.

To match this requirement in a working group, we would need an exactness in the definition of responsibilities which we can rarely, if ever, achieve. It is safer then to rely on a mortar, a bonding agent. This means that we want the direct relations between the individuals to be an important feature in the structure. As to the nature of these relations, we like to see them based on the voluntary but critical acceptance by the members, of each other's competence in his designated field. Let me illustrate my meaning with one example.

When the chemical engineer gets ready to use the work of the process chemist, it will frequently occur that the engineer feels the need of data which in his opinion are not covered by the chemist's work. He will then proceed to question the completeness of the data, but the process chemist will feel equally free to question the need for more. Without outside help or supervision they will argue their cases, and since they know that their standing in the eyes of the management depends on their ability to find a common ground, they normally do. The important practical result is, that every instance where they have been successful in doing so, increases the ease with which they will get together the next time, and gradually strong ties of mutual respect and affection develop between people who have learned to appreciate the problems with which the others have to deal, and to understand the tools they use to cope with them. These links developing all through the organization, constitute what we normally mean by team spirit.

Let us now consider the role of the



Chemical Engineering Award Dinner to Shell Development Company. Waldorf Astoria, New York, November 10, 1948.

leader of the project, the research director, or the chief engineer or whoever else he may be. It follows logically from what I have said before—it must be one of intentional insignificance. The basis for this, is the well known psychological experience that strong ties between the leader and the individual members of the group only develop at the expense of the more essential ties directly between the members. The research director's chief function is to supply the group with a climate in which it can work. His men must have the conviction that he is there to stand, and, if necessary, to fight, for the achievement of the goals towards which they are working, but in his relations to them, the utmost self restraint is necessary. In most cases he can limit his direct activity to where individual conflicts, usually the result of egotism, threaten to interfere with the smooth working of the team. However, if his own egotism (or if you prefer, his confidence in his scientific ability) tempts him to take a more active part, he is almost certain to create harm out of all proportion to what he can add. Strange as it may seem, abstention often is better than cure. Of political leaders, Lao Tse is supposed to have said what our fathers or grandfathers said about children; they should be seen but not heard. Transferred to managers of industrial research, that puts my view into a nutshell. If I seem to be giving the lie to this conviction at this very moment, please hold it against me, not against my thesis.

It seems to me that for the type of cooperative effort I have briefly sketched, this country displays a particular aptitude, in fact, a peculiar genius. For one thing, we do not, as a rule, take our individual views unreasonably seriously, and thereby we avoid one formidable obstacle to teamwork.

Another feature which promotes relationships such as I have described, is that we are happiest in close contact with our fellowmen, in work as well as in play.

Finally, I have noticed that when we do find ourselves in a hole, we do not wait to be pulled out by the magic powers of our rulers, regarding whom we normally display much healthy skepticism. No, we rather act on a conviction that we can work things out together, and put our faith in the common qualities of the American people.

It may be that this philosophy of give and take does not make ours the ideal soil for developing the type of mind that must challenge the most generally accepted views and thereby pioneers the progress of fundamental science. I do not know. On the other hand, this self reliance as a group should protect us from the slavish acceptance of the word of self appointed leaders. We have seen this willingness to give up one's right to free thought and action in matters of morals as well as of fact, flourishing ominously in central and eastern Europe in the last decades. From this abdication of the critical faculties, from this self-immolation to the leader, I believe, the gravest dangers to our civilization arise. I am therefore most happy to see right around us in these group efforts in the field of chemical engineering, expressions of a spirit of the American people which should protect us from this insidious decay. On our self reliance as a community of equals, made possible by our critical acceptance of each other's tested worth, our hope for the future rests.

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Petro-Progress

ALEXANDER FRASER
President, Shell Union Oil Corporation

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EVOLUTION of the concepts of American industry's technological and social responsibility over the period of the past 20 years has been astounding. In the 1920's this nation had already established a reputation for its outstanding ability to produce enormous quantities of goods on an assembly line technique. But today the world looks to America as a leader not only in its ability to produce, but also as a leader in technological advancement.

It was just a little more than 20 years ago that Shell Development first began to probe into the mysteries of petroleum technology. The thermal cracking process had given a new impetus to the petroleum industry, enabling it to increase the output of gasoline for the coming-of-age of the automobile.

Today, looking back over the past two decades, there spreads before our vision one of the most remarkable periods in all history—a period to whose progress petroleum has made a major contribution. Great as have been the strides during that period, we are still standing on the threshold of the "Age of Oil," and the promise of the years immediately ahead beckons us forward with outstretched arms.

Petroleum now supplies almost half the total energy requirements of our nation, but even more important is the fact that this energy is made available in the most convenient and versatile form. It has broken the shackles that for centuries had cramped man's freedom of movement. Now he is free to move with efficiency and speed—to travel far and fast, through the dimension of his own choosing—over roads, across the water, under the seas, and through the air.

In the petroleum industry this means the alchemy of scores of products whose purpose is not only to supply energy but to provide new comfort and convenience for our people, in a thousand different ways. Some of these have served as improved and cheaper substitutes for products already in use. Others have served to increase supplies of scarcer products. Still others represent totally new products—many of them newcomers to the fabulous and still growing list of oil-derived chemicals.

These new responsibilities of American industry call for the elevation of the scientist and engineer to a still higher plane in our business management. That trend is good for industry, and what is good for industry is good for America and the entire world.

This newest electrolytic installation has many advantages over other

LOCATION. Due to the mild temperatures of this region, outdoor construction is widely used, as is apparent above. Nearby supplies of water and salt, as well as a convenient market, also make this location one of the best.

Chlorine—Caustic Soda

Diamond Alkali Co. has incorporated into its newest plant, near Houston, the latest thing in plant design and equipment.

J. V. Hightower
Southwestern Editor, *Chemical Engineering*

PICTURE FLOWSHEET, PAGE 136. PHOTOGRAPHS BY ELWOOD M. PAYNE

ATTRACTED to the Texas Gulf Coast by inexpensive fuel, convenient water and rail transportation and an abundant supply of salt, Diamond Alkali Co. has built a large caustic-chlorine plant near Houston. Looking like an exhibition model by reason of its neat layout and widespread use of bright blue-green, red, white and aluminum paints, this is the largest of the chlorine plants which the company operates. Diamond has plenty of land around the Houston plant; it expects to develop other projects in the future.

Diamond Alkali has brought to the Texas Gulf Coast a caustic-chlorine plant notable for two reasons. First, the plant, near Houston, is the latest word in installations of its type, embodying many new departures. Second, the Houston plant is the nucleus for future developments at Houston by this company, which is entering the lists of southwestern chemical enterprises in a large and ambitious way.

Last month, the company formally opened its plant, lying about 15 mi. east of Houston. The new unit has a rated capacity of 220 tons of chlorine per 24 hr. At present the major products being manufactured are chlorine, 50 and 73 percent caustic solutions and hydrochloric acid. Later the list will be extended to include solid, ground and flaked caustic.

As to the future, present thinking in the company looks to a large expansion at Houston in view of the decided economies realized in the chlorine plant. The company is looking forward to advancing into chlorinated organic products to increase the over-all output of such materials which Diamond is manufacturing at other localities.

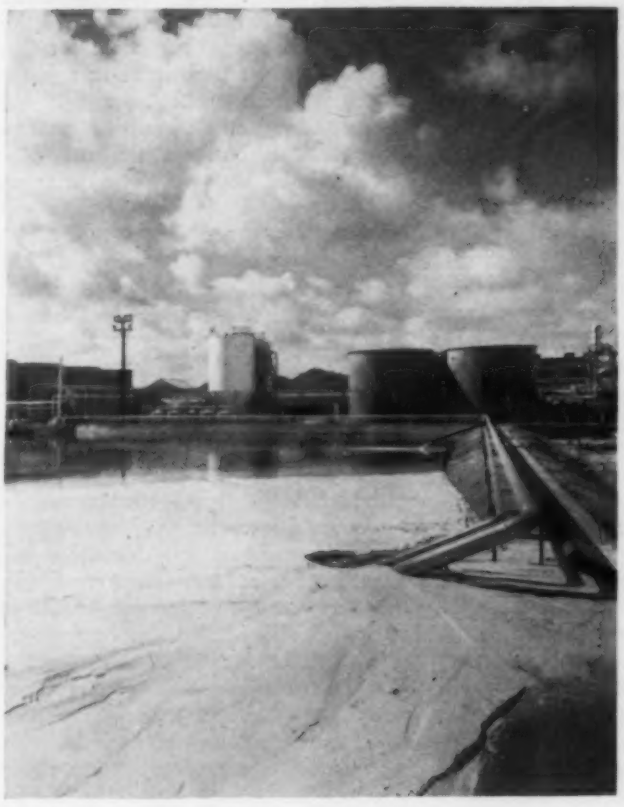
Better Because—

As it stands today, the Houston plant has many advantages over conventional electrolytic installations in other parts of the country. These include:

(1) Cheap power, through use of natural gas as a fuel and generation of power at the plant.

(2) Cheap process steam, resulting from cheap fuel and modern extraction

more conventional plants of its kind.



PLENTY OF SALT. Nearby salt is dissolved underground and brought through pipe lines to the salt reservoir above.

DUAL EQUIPMENT, such as the resaturation system above, eliminates shutdowns due to equipment failure.

BRINE PURIFICATION SYSTEM, of which filters above are part, has interesting departures from conventional method.

MODERN CONSTRUCTION MATERIALS, such as Pyrex cooling coils in these buildings, are used throughout plant.

turbines. Steam is generated at a much lower cost per pound than steam costs prevailing in eastern plants.

(3) Proximity of salt in large quantities, owned by the company, and the practice of dissolving brine underground and moving the brine through a company-owned pipeline to the plant rather than moving solid salt at railway costs.

(4) Dual system (paralleling) of equipment, beginning with treatment of brine and up to evaporation of caustic, which reduces the chance of a complete shutdown through failure of equipment along the line.

(5) Use of improved, rather than conventional, methods of brine purification.

(6) Basically improved cells.

(7) An improved, more economical system for chlorine liquefaction.

(8) An improved method of producing solid, ground and flaked caustic.

(9) Maximum use of modern materials of construction.

(10) Shell Chemical Corp., nearby, takes the major part of the output of caustic soda and liquefied chlorine via low-cost pipeline movement.

With respect to the basic raw material, common salt, Diamond has a nearby supply estimated to last 100 years or more. Seventeen miles from the plant the company has at present two fresh water wells and two wells into which the fresh water is pumped to dissolve the underlying solid salt.

Centrifugal pumps move the brine through a 17-mi. line of 10-in. cast iron pipe to the plant. At capacity operation, brine moves through the line at 550,000 gal. per day. Average composition of brine is as follows:

Sp. gr. (60/60)	1.198
SiO_2	None
Fe_2O_3, Al_2O_3	Nil
Mg	Trace
$CaSO_4$, g. per l.	4.9
NH_4 ion	Negligible
Br plus I	Negligible
NaCl, wt. percent	25.2

At the plant, provisions have been made to guard against the consequences of a possible temporary failure of brine supply. Brine flows into a raw brine reservoir, which is an open earthen pit with a wire-reinforced cement lining. The reservoir has a capacity of about 1,000,000 gal. Centrifugal pumps carry the brine to the several points in the plant as described later. If brine from the wells should be blocked for some reason, the following emergency supplies are available: a 1 million gal. raw brine reservoir, a 1½ million gal. treated brine reserve and a 15,000 ton dry salt reservoir.

The purification of brine before it enters the electrolytic cells is one of the interesting phases of the plant. The purifying process contains some departures from conventional practice.

Purification

Centrifugal pumps move brine from raw brine storage to two continuous treating tanks for removal of calcium and magnesium salts. These salts are precipitated by a mixture of sodium carbonate and sodium hydroxide contained in a saturated brine solution. Automatic controls proportion the addition of carbonate and hydroxide.

Calcium is precipitated largely as the carbonate; magnesium is thrown out principally as the hydroxide. The sodium carbonate for the purification process described above is derived as follows:

Brine containing relatively small percentages of sodium hydroxide (1 to 2 percent) is contacted in a wood-slat carbonating tower through which flue gas from the power plant moves as a source of CO_2. Effluent from this tower is returned to treat liquor storage tanks and is recycled until the desired degree of carbonation is obtained. The carbonated product is pumped to the brine treating tanks to precipitate calcium and magnesium.

Calcium and magnesium precipitate formed in the tanks is drained to a retention pond. Incidentally, the precipitate is largely calcium carbonate, which has possibilities that may later be commercialized.

To follow further the purification of brine before it enters the cells, the effluent solution from the treating tanks goes to five filters, filled with coal. These operate in parallel. They are vertical cylindrical tanks, carbon steel, 5 ft. in diameter by 6 ft. high, operating at a pressure of about 30 psig. The filters remove remnants of the precipitate carried over from the hot-process tanks. A back flow of treated brine is used to wash off the precipitate periodically to the pond. Brine is used in order not to dilute the incoming brine later.

Brine from the filters is moved through centrifugal pumps into a battery of eight treated brine storage tanks. These are of carbon steel. From the storage tanks, brine moves to a preheater, where it is heated to 160-190 deg. F. in order to raise the concentration of salt ultimately entering the cells.

Brine from the preheater enters two brine saturation tanks in parallel. Here the brine is contacted with a salt slurry that is recycled in the saturation tanks, which are of carbon steel. From the saturation tanks, brine passes through a superheater that raises the temperature of the stream to about 210 deg. F. This temperature prevents settling of salt in the lines of the cells.

Brine leaving the superheater enters a line mixer, where it is combined with hydrochloric acid to neutralize the carbonate and hydroxide residues remaining from purification. The acid is diluted with brine in order to afford close control through the use of a large volume of acid. The principal use of the acid is to break down carbonates (removing carbon dioxide) before brine enters the cells. The brine, after treatment with hydrochloric acid, moves into a system of rubber-lined steel piping to the Pyrex glass distributing system in the cell room.

Cells

The electrolytic cells embody improvements in design worked out by Diamond's research and development staff over the past 10 years. The cells are rectangular and employ a submerged asbestos paper diaphragm instead of a deposited diaphragm; the cells operate at 10,000 amp. and at average current and power efficiencies normally obtained from diaphragm cells. Power consumption (d.c.) for each ton of chlorine is between 2,300 and 2,500 kw.

At a central instrument board in the rectifier building a single operator exercises extensive and immediate control over the cell room and the power house. It is necessary to control the current load on the cells over a relatively wide range and at the same time to control within narrow limits at points within that range. The operation of three 10,000-kw. turbines and the rectifiers which feed the cell strings is directed from this instrument panel.

Chlorine

A detailed account of the purification, liquefaction and shipping of chlorine is justified in view of the materials of construction employed and several unusual processing methods. All chlorine piping in the cell room is of Pyrex glass, the joints of which are wrapped with lead strips. On being drawn from the cell room the product moves through a system of ceramic piping in the course of cooling and drying.

Chlorine leaves the cell room saturated with water vapor at about 180 deg. F. Most of the water is removed by passing the product through two sets of Pyrex glass horizontal tubes of 3-in. diameter. Each set (primary and secondary) is inclosed in a small building constructed of asbestos board walls and roofing supported on a

wooden frame. These structures are built over concrete collecting pits for the cooling water, which is sprayed over the tubes. Hinged doors in the walls permit easy access to the tubes whenever it may become necessary to do maintenance or repair work. In the primary cooler, which consists of three banks of tubes, the chlorine is cooled to 105 deg. F. by means of water at prevailing temperatures. On entering the secondary cooler the product is reduced to around 60 deg. F. by the use of refrigerated water.

Cooled chlorine next passes from the cooling system through ceramic piping into a drying system which utilizes sulphuric acid. The gas first enters the lower parts of a set of three ceramic towers, each being 4 ft. in diameter and about 30 ft. high. The bell and spigot joints of the rings comprising the towers are caulked with asbestos rope covered with a putty-like material. The up-rising chlorine is contacted with a large surface of down-moving sulphuric acid created by a ceramic baffle arrangement. In alternating succession are (1) a horizontal circular baffle having a circular hole in the center with a slightly raised lip so as to retain a level of acid on the baffle; and (2) another circular baffle, but which does not have a hole through the center. The diameter of this baffle is less than the inside diameter of the tower, and the annular space permits the movement of chlorine. The circumference of the baffle has a raised lip in order to retain a surface of acid.

The baffle arrangement causes the chlorine to pass in succession through a film of acid dropping through the holed baffles, across the acid surface on these baffles, through the acid film dropping from the peripheries of the other type of baffles, then over the surface of acid on those baffles, and finally through the holed baffles again. The acid leaving the base of the ceramic towers is not recycled but is marketed as 80 percent acid.

Drying Towers

From the ceramic towers the partially dried chlorine passes into the bases of three cast iron drying towers in parallel flow. These towers have about the same dimensions as the ceramic towers and are packed with 20 ft. of 2-in. Raschig rings. Since the dew point of the moisture in the gas entering the cast iron towers is 0 deg. F., little corrosion is expected. Sulphuric acid flows continuously through the towers in parallel flow and is recycled from a carbon steel receiving tank back to the towers through a vertical centrifugal pump.

From the towers dry chlorine is drawn through a battery of five Nash Hytor pumps connected in parallel, is compressed to between 40 and 45 psig. and then enters three scrubbers in parallel to be freed of remaining traces of sulphuric acid and organic matter. The scrubbers are vertical cylindrical vessels of carbon steel, the material used to handle chlorine after it has left the drying towers, and are packed with coke.

Chlorine Liquefaction

Next, the chlorine passes into an unusual liquefaction system which eliminates the use of the calcium chloride brine now generally employed by the industry. Initially the chlorine enters three centrifugal type of Carrier refrigeration units operating in parallel, each of which has a capacity of 100 tons of chlorine per 24 hr. Passing through the carbon steel shell and tube exchangers the gas is chilled and liquefied by liquid Freon vaporizing on the outside of the tubes. Freon vapors are drawn at a vacuum of 27 in. of mercury into the three-stage compressors of the units, liquefied in a water-cooled condenser and recycled to the exchangers. From 95 to 98 percent by weight of the chlorine entering the exchangers is liquefied.

Conventional chlorine liquefaction methods employ calcium chloride brine as an intermediate coolant between the refrigeration and chlorine liquefaction stages. The system in use at the new Diamond Alkali plant eliminates the brine and makes unnecessary one exchanger. It also reduces the requirements for pumps and piping. The heat transfer is direct between chlorine and Freon instead of a two-stage transfer involving refrigerant, brine and chlorine. This simplification makes lower temperatures available for liquefaction under similar refrigeration temperatures.

Liquid chlorine flows by gravity to any one of four beam-scale weigh tanks and is then transferred into cylinders, tank cars or to a pipeline running to the nearby Shell Chemical Corp. plant. No chlorine storage tanks are used. Sufficient storage capacity is furnished by the weigh tanks (each with a capacity of 50 tons) and the empty tank cars at the Diamond plant.

A high percentage of both chlorine and caustic produced at the plant is moved by pipelines to Shell. The 10,300-ft. line carrying chlorine is probably the longest such line in the world. It is a 3-in. seamless steel line with welded joints. In order to make it possible to detect quickly any point of leakage, the aluminum-painted line is not insulated and is supported above-ground on conventional pipe stanchions. Over much of the distance the line is close to the ground to facilitate maintenance and repairs. The line can deliver about 140 tons of chlorine in 24 hr. At the Diamond end the chlorine is moved into the line from a tank pressured by dry air from one of two alumina gel dryers.

At the Shell end of the line the receiving tanks are so designed as to protect the line from dangerous over pressures that might conceivably develop. A rupture disk is installed in the piping between the pipeline and the receiving tanks. If valves at both ends of the line should be closed, after an interval of time heat from the sun would build up pressure sufficient to break the disk and allow chlorine to flow into storage.

Hydrochloric Acid

A compact unit in the Diamond plant utilizes part of the chlorine to manufacture hydrochloric acid, and has a rated capacity of 10 tons of 33 percent acid per 24 hr. Charge to the unit is a gas containing a relatively low concentration of chlorine from the recompression system after chlorine liquefaction. From the compressor the gas moves to a furnace and is combined with hydrogen from the cell room. The mixture passes through a silica tube inserted in one end of a horizontal, cylindrical, refractory-lined chamber. Combustion products leaving the tube pass through the chamber and enter a Karbate cooler. The cooled gases then enter an absorber which utilizes water as the absorbing agent. Here, most of the hydrogen chloride is absorbed and, after concentration has been built up, is pumped to hydrochloric acid storage.

Spent gas from the absorber is passed through a water scrubber for removal of the last traces of acid before the residual gas is released to the atmosphere. Water leaving the scrubber is that which is used in the absorber. All equipment used for handling HCl or the acid is of silica, Karbate, ceramic or rubber-lined carbon steel.

Caustic

Turning now to caustic production, caustic recovered from cell liquor averages from 96 to 98.5 percent by weight. The liquor leaves the cells with a concentration of about 11 percent NaOH and 15 percent NaCl and flows by gravity to two carbon steel collecting sumps. A vertical centrifugal pump moves the liquor onward to six vertical cylindrical storage tanks each having a capacity of about 185,000 gal. From storage the liquor moves to primary evaporation, where con-

centration of the liquor to 35 percent caustic strength occurs in three sets of double-effect evaporators operating in parallel. The evaporators are of forced circulation type with external steam chests. Cell liquor is concentrated to about 20 percent NaOH in the first effect and 35 percent in the second effect.

Settling

Salt slurry in the second effect is circulated through a salt settler where solid NaCl is removed from the settler as a concentrated slurry which then flows by gravity to a salt slurry tank. Caustic solution relatively free of suspended salt is then returned to the evaporator for further concentration.

Caustic from the settler, when up to satisfactory concentration, is discharged into the feed tank for single-effect evaporation. Salt from the single-effect evaporator salt settler moves into the slurry tank mentioned above. The slurry, which contains about 30 percent suspended salt, is fed to three continuous rotary vacuum filters, and the filtrate flows by gravity to one of three feed tanks for three single-effect evaporators. Feed to the evaporators contains about 35 percent caustic and is raised to 50 percent in the single-effect equipment. From this equipment the caustic is pumped to a salt settler from which a concentrated salt slurry flows by gravity to the slurry tank. Caustic solution relatively free of suspended salt flows from the settler to four caustic cooling tanks.

Referring again to the rotary salt filters, salt from this equipment is removed, after having been washed with water to reduce the caustic concentration, and moves by gravity to a salt slurry tank. Salt from this slurry tank is moved through a centrifugal pump at about 30 percent solids content to a classifier which removes solid salt and permits the return of liquor to the slurry tank. This liquor system allows the accumulation of sulphates, which are purged at a fairly high concentration to the pond and thereby prevented from being recycled in the salt stream eventually back to the cells.

From the classifier salt is moved by a screw conveyor to a second salt slurry tank where it is made up to approximately 30 percent solids concentration. Salt from this tank may go to two different points: (1) to the resaturation tanks previously described; or (2) to the salt storage reservoir, from which salt is recycled to brine treatment and thence to the cells again. While solid salt settles out in the reservoir, saturated brine is also circulated through centrifugal pumps to the slurry tank to bring out additional salt.

Fifty percent caustic is cooled to 100 deg. F. by passing through two shell and tube primary water coolers and is bleached. The caustic is then cooled to about 60 deg. F. in shell and tube secondary coolers using refrigerated water from equipment consisting of two-stage jets capable of cooling 720 gpm. of water from 95 deg. F. down to 65 deg. F. Such refrigeration is uncommon in caustic plants.

The caustic is then pumped to one or two Vallez filters connected in parallel. Salt crystals which precipitate during the previous cooling are removed, and the caustic containing about one percent NaCl is pumped to storage from which it is loaded into cars or sent by pipeline to the Shell Chemical plant.

73% Caustic

Caustic from the Vallez filters can be further concentrated to 73 percent strength. In this operation the 50 percent caustic flows by gravity to the feed tank for 73 percent operation. From the tank the solution moves through a preheater to a single-effect evaporator having a vertical external tube bundle. Concentration to 73 percent is accomplished at a vacuum of 27 in. of mercury. The product is stored in insulated, nickel-lined tanks containing nickel heating coils.

All material used in the evaporators described above is cast iron or carbon steel with the following exceptions: Evaporator tubes are nickel or Inconel. Single-effect evaporators are Inconel-clad and the piping is of nickel. The 73 percent evaporator is nickel-clad.

Early next year it is planned that the Houston plant will be producing ground, solid and flake caustic in facilities of the company's own design.

In the operation 73 percent caustic from storage is pumped dehydrated continuously. The product may be drummed as solid caustic, or sent through a flaker to produce flaked caustic, or may be ground after flaking and drummed as ground caustic.

With respect to general features of the plant a high degree of instrumentation is used throughout for process control. This is one of the elements responsible for reducing process difficulties and minimizing manufacturing costs. The absence of a large number of operators is noticeable. The entire plant staff for three shifts, including office and technical personnel, numbers only about 200.

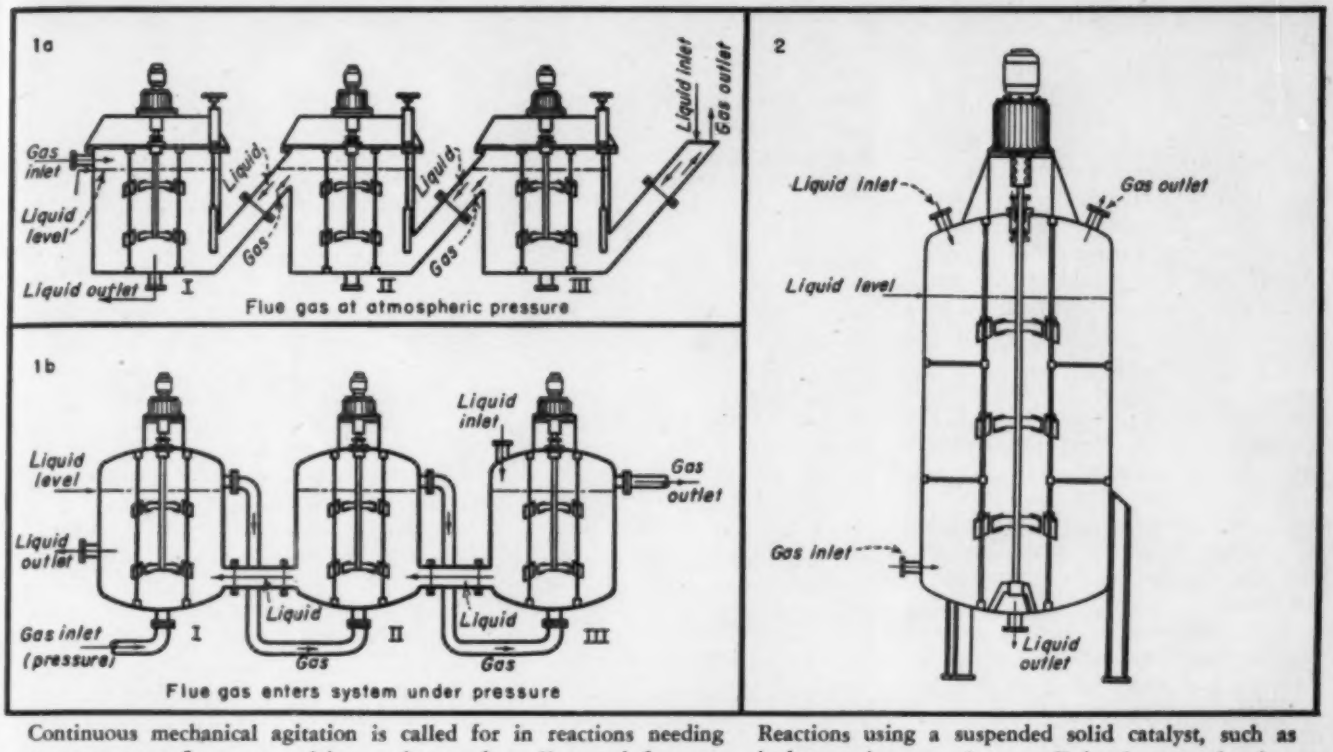
Outdoor construction is widely used, thanks to the mild temperatures prevailing in the vicinity most of the year. The boilers are outside, as are the evaporators and much of the other process equipment. Although every precaution has been taken to prevent leakage of chlorine, the minimum use of housing of equipment is an advantage in reducing the possibilities of accidental accumulation of chlorine gas.

In areas where corrosion is most likely to occur, corrosion-resistant materials of construction are prevalent. The rectifier building is of concrete block on steel design, with windows of glass brick and a poured concrete roof with a bituminous topping. The walls of the cell room are of asbestos board topped with a concrete roof. Most of the other buildings have asbestos siding on steel frames. Concrete floors are general throughout the plant. Corrosion-resistant paint is widely used for protection of steel.

The change room for operators and other plant workers is designed to minimize odors and the decay of moist clothing frequently encountered in the Gulf Coast area during the warm, humid months of summer. The room has an unusually high ceiling and free ventilation to permit the circulation of air. Conventional steel lockers have been eliminated. Employees are assigned large open wire baskets which can be raised by chains against the ceiling and locked in place. The baskets may be used to contain various items, and their capacity can be increased by the attachment of coat hangers which permit clothing to be suspended and easily ventilated.

Utilities

As regards utilities, the plant is self-sufficient. Four boilers, each rated at 100,000 lb. per hr., and operating at 900 psig., furnish steam for all requirements. These are fired with natural gas. A maximum of 10,000,000 lb. of steam is generated per 24 hr. For every 1,000 lb. of steam generated, from 1,200 to 1,400 cu. ft. of natural gas is burned. Maximum 24-hr. demand for natural gas is 14,000,000 cu. ft. Water is furnished from the plant's own wells. Maximum circulation of cooling water per 24 hr. is 60,000,000 gal. In addition to the three 10,000-kw. turbines furnishing power for the cells, there is a 1,000-kw. turbine which would supply utility requirements in case of an emergency and operate boiler auxiliaries. If a complete shutdown should occur, a gasoline pump is available for furnishing water until sufficient steam is generated to operate the 1,000-kw. turbine. Maximum 24-hr. demand for power (a.c.) is 720,000 kwh.



Continuous mechanical agitation is called for in reactions needing countercurrent flow, e.g., calcium carbonate from lime and flue gas.

Reactions using a suspended solid catalyst, such as hydrogenations, employ a tall batch type absorber.

Agitated Gas Absorbers

Towers and scrubbers are used for large quantities of gas, but mechanical agitators fit in better where considerable amounts of solids are present.

Kenneth S. Valentine
The Patterson Foundry & Machine Co.
New York, N. Y.

GAS ABSORPTION, sometimes to bring about a reaction, and frequently for the sole purpose of dissolving a gas in a liquid, is one of the most used unit operations. To quote from the "Chemical Engineers' Handbook" (p. 1122, 2nd Ed.): "Gas absorption in the usual sense involves the transfer of gas from the gas phase into a liquid in which it is more or less soluble." The operation is being applied to innumerable gases and an almost infinite variety of organic and inorganic liquids, often in the presence of solids.

Many of the reactions accomplished by gas absorption involve not only the common gases, such as air, ammonia, bromine, carbon dioxide, chlorine, hydrogen, oxygen and sulphur dioxide, but also less common ones, such as methane, ethane, ethylene, propylene, acetylene and methyl chloride. In many absorptions a pure gas is used. On the other hand it is often desired to absorb one gas from a mixture of gases, for example, the absorption of oxygen from air.

The types of equipment for this work fall into three general groups: (1) towers, (2) scrubbers, and (3) mechanical agitators within a container. In packed towers, spray towers or scrubbers the gas is brought into contact with a film or spray of liquid. Usually the flow is countercurrent.

Mechanical agitators operated within a vessel and immersed in the liquid are preferably of a type which is specially designed for gas absorption. A design which has been successfully used in large scale operation is illustrated in Figs. 1 and 2. The impeller has an integral cover which is curved downwardly. The surrounding stator or deflecting blade ring also has a cover which continues the downward curve of the impeller cover. Because of the downward discharge from the impellers, the liquid and gas describe a path which is rather spherical, or more like a doughnut or torus. This lengthened path serves to hold the gas in contact with the liquid for a longer period. When the gas is discharged from the impeller through the stationary ring it is broken up into particles.

In a tall vessel (which is ideal for absorption) a series of impellers may be used, one above the other, and in each one this same path is repeated. The top impeller is often placed near the surface so that the gas which has escaped can be sucked from the space above the liquid and recirculated. In such an absorber the impeller itself will handle up to 40 percent of gas by volume, based on the total pumping capacity of the impeller, provided the gas is injected under the impeller. However, this maximum quantity will not be subdivided as finely as when a smaller volume of gas is injected, such as 20 to 25 percent. When a gas absorber unit is located near the surface of the liquid it is capable of sucking in gas from the space above the liquid to the extent of about 10 percent of its total pumping capacity.

In selecting the most suitable equipment for a particular gas absorption (aside from the corrosion problem)

the following factors are the most important:

(1). The relative quantity of gas and liquid. If the quantity of gas is enormous as compared to the liquid, as in ammonia recovery, a mechanical gas absorber within a vessel cannot be used because such a device depends on the actual pumping of a mixture of liquid and gas through the impeller. About 500 cfm. would be the maximum that could be well handled by a 60-in. impeller, which is about the largest effective size.

(2). The amount of solids present or formed during the reaction. If the quantity is great, towers or scrubbers may become plugged, and the mechanical absorber then has the advantage. For instance, in the preparation of calcium carbonate from lime and flue gas, clogging solids are present at all times.

(3). Reactions between a gas and liquid where there are solids in suspension, such as a catalyst or an initiator. In this case very intimate mixing is required because of the resistance of the liquid film, or on account of low solubility of the gas. Hydrogenation is an example.

In the first case above, towers or scrubbers are preferable, but in the second and third, mechanical agitators of the gas absorption type are definitely indicated. The following specific examples are illustrative of mechanical systems which would be applicable to a variety of uses.

Use of Agitated Absorbers

Calcium Carbonate From Lime and Flue Gas—This is a system which is suitable for Case (2) above. Only the CO_2 in the flue gas is utilizable. This amounts to about 10 percent of the total gas volume. The inert gas constituents therefore have to pass out of the system. In order to convert all of the lime to carbonate and to utilize all of the CO_2, a countercurrent system is advisable, preferably three-stage, as shown in Fig. 1*a* for gas at atmospheric pressure and Fig. 1*b* for gas under sufficient pressure to overcome the total head of liquid in three tanks.

In Fig. 1*a* two gas absorber impellers and stationary rings are employed in each vessel, one above the other. The top impeller is located at the correct distance below the surface of the liquid to produce the best suction of gas into the liquid from the open space above. The vigorous action of the turbine type gas absorber produces a fine dispersion of gas in the liquid promoting contact between calcium hydroxide in solution and the gas. The vigorous action also causes rapid solution of the solid calcium hydroxide, keeping the $Ca(OH)_2$ concentration near the saturation point. There is sufficient side thrust in the liquid owing to impeller action to kick a large proportion of the total gas into the inclined risers which connect the tanks. The amount of gas passing forward through the system can be regulated by means of the gates. Fresh liquid meets the spent flue gas in the third stage, thus removing practically all of the CO_2. Similarly, fresh flue gas meets the almost completely reacted lime in the first stage, therefore, according to the law of mass action, promoting almost complete conversion to calcium carbonate. In Fig. 1*b* the flue gas has been somewhat compressed before entering the system. Here it is better to introduce it under the lower impeller in each stage. The liquid flows from the third to the first stage at the required rate through connecting pipes, with gas flow in the opposite direction. Otherwise the pressure system is the same as the atmospheric system.

This same system, of course, is applicable to any other case where such solid matter is present and where the active constituent of the gas should be completely absorbed. For instance, it is satisfactory in a phenol process for neutralization of sodium phenolate-caustic soda mixture with impure SO_2. During the reaction, quantities of sodium sulphite are precipitated.

When any reaction takes place easily, one tank instead of three may be sufficient.

Hydrogenation of a Vegetable Oil, Such as Coconut—This is a system of the type given in Case (3) above. Here pure hydrogen is used and completely reacted with the oil in presence of a catalyst until the unsaturates have taken up their quota of hydrogen. Fig. 2 illustrates the best type of hydrogenator. The vessel is built for pressure and is preferably tall. Three or more gas absorber units, one above the other, may be used. Hydrogen enters under the bottom unit and, in the case of three impellers, passes through three distinct zones of intensive dispersing action before any of it reaches the surface. The top impeller is set near the surface so that it can suck back hydrogen into the liquid from the space above. Thus complete and rapid absorption is assured.

A similar type of machine produces best results on nearly all hydrogenations involving a liquid and a catalyst —for instance, the saturation of unsaturated aliphatics or side chains, or the reduction of a carboxyl or carbonyl group to an alcohol. It is also equally useful for similar work with any other gas, such as oxidation, amidation, acetylation, and many more.

Some reactions proceed so readily that only a simple type of agitator such as a plain impeller or propeiler is required, for example, the preparation of bleach liquor from lime and chlorine.

The gas disperser agitator is also excellent for producing foams by sucking large volumes of air from above the liquid and finely dispersing this air in the liquid. An example is ore flotation.

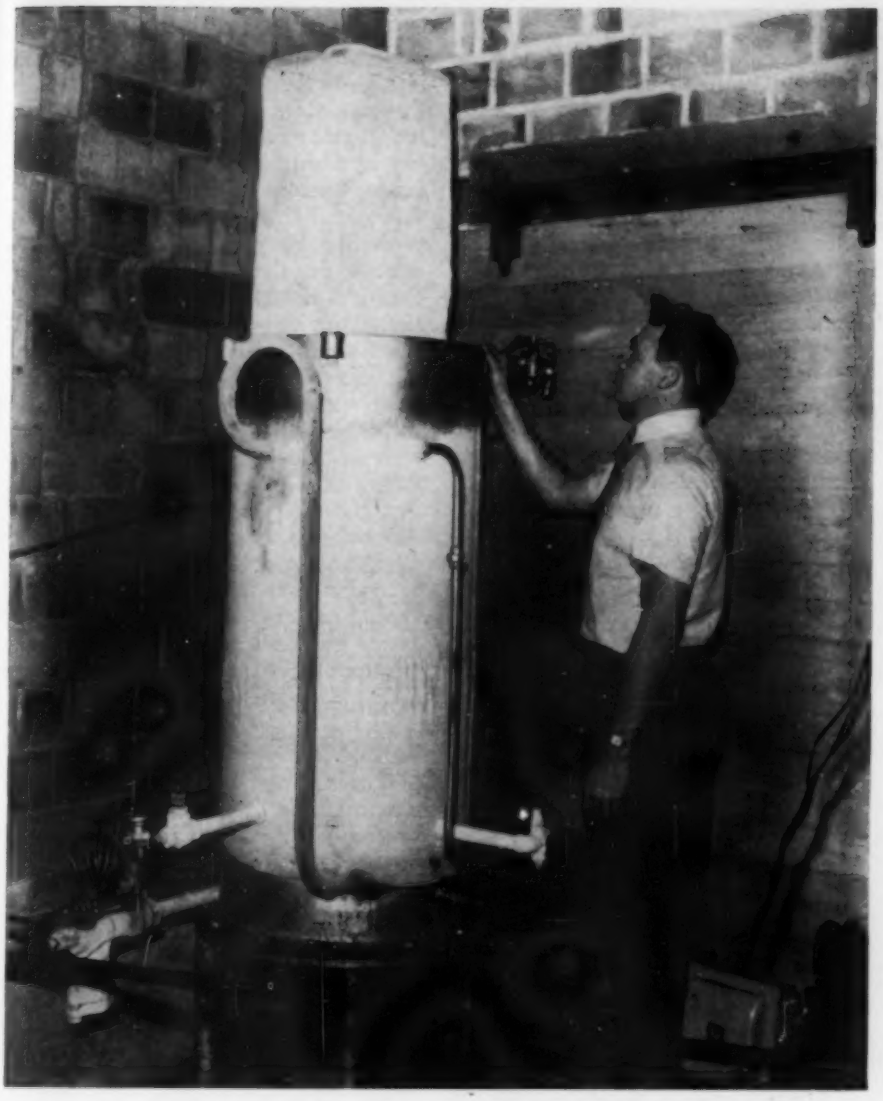
Tool for Unit Processes

A few other interesting examples of industrial gas absorption include the production of aniline by amination of chlorobenzene, using gaseous ammonia; the bromination of allyl alcohol; the chlorination of benzene and the preparation of bleaches such as high-test hypochlorite; oxidation of acetaldehyde, ethyl alcohol and octylene or octylene alcohols; and the sulphonation of quinone in aqueous solution, or of benzene by the vapor phase process.

A rapidly developing field is the product of hydroxy or aldehydic fatty acids for use in soaps, fats and esters. Subsequently, these fatty acids may be hydrogenated to high-molecular-weight alcohols which are sulphonated and converted to detergents. During World War II, 100,000 tons of fatty acids was produced by oxidation of various hydrocarbons. The absorption of oxygen is also a necessary part of the penicillin and streptomycin processes.

The exact design of the gas absorption mechanism depends greatly on the size of the equipment. In a laboratory or pilot plant batch any gas can be dispersed more easily than on a large scale, and it is often possible to obtain such a fine dispersion of the gas in the liquid that a volume increase of 100 percent may be obtained with a comparatively inefficient mechanism. However, in large-scale operation it is rarely possible to obtain a volume increase of more than 25 percent with the best mechanism available, unless the liquid possesses marked foaming characteristics. Nevertheless, with properly designed mechanism, first-rate gas-liquid reactions have been carried out on batches of 10,000 gal., and more. It is only necessary to use care in translating pilot plant results to large scale operation.

When gas absorption problems arise it is advisable to obtain the recommendations of those skilled in the art, particularly since, in the majority of cases, it is desirable to run small scale tests before plant equipment is specified.



First commercial size block ice machine. It is as fast (80 lb. per hr.) as ice flake machines and more economical than can ice systems.

Continuous Block Ice Extruder

Without brine, ice cans or labor, you can now generate hard white ice continuously, rapidly and economically.

John R. Watt
Department of Mechanical Engineering
University of Texas, Austin, Tex.

EXPERIMENTS at the University of Texas since 1943 have resulted in the development of a continuous process for generating ice cakes without brine, ice cans or labor. Direct-expansion freezing cylinders extrude hard white ice in continuous columns suitable for automatic severing into cakes. The "incremental film" principle permits about 10 lb. of ice per hour to be formed for every square foot of freezing surface at a suction pressure corresponding to 5 deg. F. This output is about 30 times greater than that achieved in ice-plant practice. The pilot model, a 1-ton commercial machine, has one moving part and requires only 3 sq. ft. of floor space. It generates 12 x 15 in. cakes of any length. Operating costs are low.

Today many industries are still dependent upon the slow can-ice system with its large and increasing capital and labor requirements. The very nature of this process discourages improvement. Faster heat transfer in the can is impeded by the ice itself, while colder brine causes cloudiness and cracking of the ice. Thus any cheapening of can ice seems difficult.

To overcome this, continuous ice-generating systems are now finding use, notably York's Flakice and ice-cube machine, Vilter's Pakice, Vogt's Tube-Ice and the new Knowles Belt-Ice, manufactured in Seattle. These fast processes manufacture ice at remarkable savings. But they may incur storage problems. Ice flakes and snow ice require double space, while briquettes often freeze together in storage. Consequently no rapid freezing system yet competes where storage is significant. Furthermore, flakes and briquettes are not as satisfactory in refrigerator cars as cake ice.

Initial Work

Experiments, begun at the University of Texas in 1943, had as their goal a continuous process for making cake ice. First tests disclosed that the bond between ice and steel fails in shear between 10 and 30 psi., while the corresponding ice strength exceeds 100 psi. It was proved practicable (1) to shear ice intact from a submerged freezing surface, (2) to freeze water between the two, thus forming a new ice layer bonded to the old, and (3) to repeat the process layer by layer to generate solid blocks of desired size and shape.

Accordingly, a small machine was constructed. Basically, it was a tank of water in which a double-walled tapered freezing cylinder was mounted big end up and cooled by direct expansion. A perforated ram reciprocated vertically in the lower (or small end) of the cylinder, driven by an eccentric and rocker arm. Later, the eccentric was replaced by cams to give the ram a dwell or "freezing period" between strokes.

When run rapidly, this machine formed nesting circular ice shells about $\frac{1}{16}$ in. thick, like nested paper cups. When run slowly, it made a broken hollow column of white ice with walls $\frac{1}{8}$ in. thick, thus proving that generating thick sections from thin layers was possible.

A second freezing cylinder, of $3\frac{1}{8}$ in. diameter and different taper, was made and polished to reduce ice adhesion. It soon established that a four-way compromise was necessary; temperature, freezing time, lift of ram and cylinder taper must all be reconciled. After a reservoir of chilled water was installed at the top, the new

cylinder achieved solid ice cakes in early 1946.

Operation was as follows: With the ram in low position and the machine filled with water, an ice core was frozen in the tapered cylinder. When this was solid, the ram mechanism was started, periodically shearing the ice core from the cell walls and lifting it intact about ⅛ in. Since both core and cylinder were tapered, lifting the ice opened a thin annular void entirely around it. Suction and capillary action filled this with water from the reservoir while the ram returned to its original position. The water film was about $\frac{1}{64}$ in. thick and froze in 10 to 15 sec., depending upon temperatures.

Each successive new layer of ice (called the "incremental film") froze integrally to the one before. Each cycle therefore added new ice below and around the core, forming a column that extruded step by step upward out of the cylinder. About 4 to 5 cycles per min. gave optimum output.

With −10 deg. F. suction temperature, the ice-freezing rate approximated 27 lb. per sq. ft. of freezing surface per hr. The heat transfer was about 72 Btu. per (sq. ft.) (hr.) (deg. F.) temperature difference, or about 70 times the estimated over-all heat transfer in a can-ice plant.

The machine was finally altered to cut the ice column automatically into 5-in. lengths.

Second Series of Experiments

In June 1946 the author was employed by C. W. Murchison of Dallas, Tex., to adapt this process to the freezing of citrus juices. Three experimental cylinders were built. These cylinders were operated by cam-driven rams and had a tank-type precooler. The low temperatures employed exaggerated test outputs. Using a 3-hp. Freon compressor, equipped with an oil separator, the freezing temperature ranged between −10 and −15 deg. F., a level designed more for citrus juices than for ice. As expected, heat-transfer rates fell below those for the laboratory machine; the minimum water film was necessarily thicker, slowing the cyclic rate to about 2.3 lifts a minute. Nevertheless, the net performance still approached 50 times the estimated over-all average of brine-tank systems.

First Commercial Machine

In 1948 a 1-ton ice-making machine was designed as a pilot commercial plant. It was built by the Modern Supply Co. of Austin, Tex., and was tested briefly there.

This machine has a tapered rectangular inner cylinder which extrudes an ice column 12 in. × 15 in. in cross-section. The inner cylinder is welded from unpolished flat panels of ¼-in. boiler plate, stiffened longitudinally by ribs in the refrigerant space, and welded permanently into the refrigerant jacket of ¼-in. rolled steel. It provides a net freezing surface of 8.65 sq. ft.

Below the jacket is a precooling chamber, refrigerated both by conduction and by suction gases from the evaporator. A thermostatic expansion valve controls both jacket and precooler. Water enters the machine through a float valve and is precooled to about 40 deg. F. before reaching the reservoir in the top extension of the jacket.

The ram is square and is the only moving part on the freezing machine. It is operated by a hydraulic cylinder below the precooler, the piston rod and the ram retreating into the precooling space between strokes. The hydraulic cylinder is controlled by a Vickers "Power-Pack," a compact hydraulic power unit containing pump, oil reservoir, filter, relief valve and four-way slide valve in one casting. A ½₀-hp. timing motor and cam actuate the slide valve and through it the ram of the freezing cylinder. Both timing and stroke are adjustable.

This power unit runs idle between ram movements. Since it is built for two additional slide valves, it should drive three freezing cylinders economically instead of one. Power consumption when running idle, about 0.6 kw. per hr., would thus be eliminated, while multiple use of the pump should reduce the net investment. There are no other auxiliaries.

Refrigeration is supplied by a 3-hp. Brunner air-cooled Freon compressor charged with methyl chloride. A suction-line heat exchanger is used; there is no oil separator, and no difficulty has been experienced with oil-logging in the full-flooded evaporator.

Cutoff Mechanism

Thus far no ice cutoff device has been installed. Several automatic arrangements seem applicable, and no difficulty is anticipated in severing 25-, 50-, 75- or 100-lb. lengths for discharge by chute. Similarly, no special difficulties are seen in the construction of multi-cylinder ice plants. The present machine occupies about 3 ft. × 3 ft. and generates 1 ton. Welded into one full-flooded casing and controlled by one expansion valve, it seems likely that a four-cylinder 5-ton machine can be built into 3 ft. × 12 ft.

Tests at the Electro-Watt oil burner and furnace plant in Seattle indicate that the 1-ton commercial machine performs about as anticipated. It turns out 1,920 lb. of ice in 24 hr., or 9.25 lb. per sq. ft. of freezing surface per hr. The ice cakes are hard and solid, but not brittle. Although visible, the laminations are permanently bonded together. The ice melts, chips and fractures like ordinary ice. Its opacity is due to dissolved gases in the water and does not affect the cooling qualities. Thus this machine makes solid cakes as fast as other machines make ice flakes. The heat-transfer rate, 51.4 Btu. per (sq. ft.) (hr.) (deg. F.), seems greater, due to $\frac{1}{32}$-in. film thickness instead of 0.070-in. to 0.10-in. flake thickness. More important, this first commercial machine shows little diminution in heat transfer from the laboratory cylinders; consequently, the extrusion of standard 300-lb. bars should be comparably fast. All told, it seems justifiable to rate the incremental freezing system as about 30 times faster than comparable can-ice plants.

Proposed Improvement

The shear-off forces encountered in this machine suggest that its freezing surface could be increased safely to 10 sq. ft. Output, non-insulated, should then exceed 92.5 lb. per hr., while power costs should fall below 58 kwh. per ton. Insulation, use of Freon or ammonia instead of methyl chloride, and multi-cylinder installations should further improve the economy. Direct ice costs under $1 per ton seem likely where power rates permit.

Conclusions

In summary, the extrusion process suggests these economies: (1) building space requirements are reduced about 80 percent; (2) installation costs are low; (3) equipment is cheaper than a brine tank and cans; (4) existing compressors can be used; (5) there is only one auxiliary; (6) no corrosion problem is foreseen; (7) refrigeration and radiation losses are reduced; and (8) labor costs are pared. The process should be applicable wherever white ice is acceptable. There should be wide markets. Since both investment and operating costs are low, extrusion equipment should appeal to many ice plants wherein replacement or expansion is planned.

This article is based on a paper presented before the American Society of Mechanical Engineers, New York, Nov. 28 to Dec. 3, 1948. The paper was a contribution of the Process Industries Division.

For More Information

Watt, J. R., "The High-Speed Production of Ice," *Ice and Refrigeration*, May 1946, pp. 17-19.

Watt, J. R., "Producing Block Ice by Automatic Machine," *Ice and Refrigeration*, October 1947, pp. 19-20.

Table I—Saskatchewan Producers of Natural Sodium Sulphate

Producer	Plant Location	Production, Tons 1947	1948, Est.
Horseshoe Lake Mining Co.	Ormiston	41,217	55,000
Midwest Chemicals, Inc.	Palo	39,291	40,000
Natural Sodium Products, Inc.	Bishopric	55,342	40,000
Natural Sodium Products, Inc.	Alsask	.....	25,000
Saskatchewan Minerals	Chaplin	.....	48,000*
Sybouts Sodium Products Co.	Gladmar	18,990	20,000
Total	.....	154,840	228,000

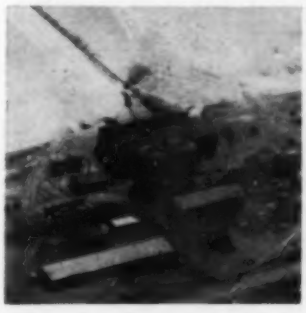
* Production started with one unit only on May 7, 1948. Design capacity of plant placed at 150,000 tons yearly.

Table II—Estimated Consumption of Salt Cake, Tons

	1947	1948	1949*
United States sulphate pulp mills	705,700	.....	.....
Canadian sulphate pulp mills	106,500	.....	151,500
Mexican and S. American pulp mills	6,600	.....	.....
Total sulphate pulp mills	818,800	933,300	997,800
Detergent industry	100,000	250,000	300,000
Glass, tanning and dyeing industries	150,000	175,000	175,000
Total requirements	1,068,000	1,358,300	1,472,800

* Estimate as of March 10, 1948.

Drawing on world's largest natural deposit, new Chaplin plant has capacity equal to one fourth of all U.S. production. Kraft and detergents are the big consumers. New Saskatchewan capacity means more for U.S. next year; we can use it.



More Saskatchewan Salt Cake

New plant is one of America's largest. And improved evaporators make it one of the most efficient.

A. A. Holland

Consulting Engineer, Chaplin, Sask.

THE WORLD'S largest known deposits of natural sodium sulphate, generally called "alkali" throughout western Canada, are located in the province of Saskatchewan: reserves are estimated to exceed 200,000,000 tons. It occurs, of course, in various other semi-arid regions of the world such as Russia, the United States, Germany and Austria. In some areas, underground deposits formed hundreds of thousands of years ago have been located by drilling, indicating that they were formed under arid or semi-arid conditions. Here is the master key to the location of deposits of natural sodium sulphate: a climate, either past or present, where evaporation exceeds precipitation over a considerable period of time.

Commercial development of these natural deposits of sulphate in Saskatchewan began about 30 years ago. Previously, the demand had largely been met by salt cake produced as a byproduct from the manufacture of hydrochloric acid from salt. The rapid increase in the production of kraft paper and, more recently, the development of synthetic detergent materials have caused a marked increase in the market for sodium sulphate. This chemical gives the extra toughness to kraft paper and is used in detergent compositions in proportions as high as 75 percent.

Saskatchewan now has six commercial plants producing natural sodium sulphate (see Table I). The newest and largest of these is the plant of Saskatchewan Minerals at Chaplin which is designed to produce up to 150,000 tons of 98.5-99.5 percent salt cake yearly. This one plant's capacity actually amounts to about 24 percent of the total United States production of crude commercial salt cake for 1947.

Lake Chaplin Project

Lake Chaplin is located 60 miles west of Moose Jaw on the main line of the Canadian Pacific Railroad. Although the lake has been known to contain "alkali" from the time of the first settlers, no attempt was made to investigate or develop this valuable deposit until work was begun in the spring of 1946 by the Saskatchewan Government.

Unlike the usual deposits of sodium sulphate in Saskatchewan, Lake Chaplin is a "brine lake," since in the spring and early summer the bulk of Glauber's salt is dissolved by spring run-off and June rains. It remains in this brine condition until the fall of the year; at this time all surface moisture evaporates and the crystal bed hardens. The lake is shallow and has a crystal bed only 14-24 in. thick. Nevertheless, the deposit covers an area of 18.6 sq.mi. and contains an estimated 15,000,000 tons of Glauber's salt.

Design of the plant and ordering of equipment was done in the winter of 1946-47, but difficulties in obtaining equipment and shortages of steel and other materials made it impossible to complete the plant before 1948. The first line was placed in production on May 7 of that year. The publicly-owned project is operated by the provincial government as the Sodium Sulphate Division of Saskatchewan Minerals. It is the largest and most modern plant in the province devoted entirely to the production of sodium sulphate.

The main manufacturing building, which is 144x82 ft., is constructed of steel and tile so as to be completely fireproof. Miscellaneous facilities include: (1) a 100x30-ft. machine shop with complete facilities for construction or repair of any equipment that might be necessary during operations; (2) a completely equipped carpenter shop, with power tools, and a garage for repair of shovels, tractors and automotive equipment; (3) a 185x30-ft. heavy-supply storehouse. The plant is operated by electric energy supplied by the Saskatchewan Power Commission. This now comes from the Swift Current power plant; later it will be brought in from the Moose Jaw district.

Crystal Harvesting

There were two reasons why it was decided not to use the usual Saskatchewan method of harvesting the crude salts with a power shovel and backdigger: (1) the thin crystal bed has insufficient strength to carry the weight of such machinery; (2) quality of the salt would be harmed by the inclusion of mud and other impurities. Instead, harvesting is done by means of pumping. A 6,000-ft. ditch was dug across the lake to bring the brine to the pump house; from here it is pumped into three reservoirs, each 1,000,000 sq.ft. in area and with banks 11-15 ft. high.

The first pump had a capacity of

5,500 gal. of brine per minute. A second pump, now being installed, will add 12,000 gal. to make a total of 17,500 gal. of brine that can be pumped into the reservoirs each minute. Pumping is done only during warm weather when the brine contains the maximum amount of dissolved Glauber's salt. As the weather becomes cool, the Glauber's forms crystals that drop to the bottom of the solution. By early November, only a weak brine is left.

During the 1947 pumping season, about 170,000,000 gal. of brine was pumped to the reservoirs. About the first of November, the brine was drained off; a crystal bed 4-10 ft. thick was left behind. During the winter months these crystals were harvested by bulldozers and draglines and placed in two stockpiles. Each was 1,000x140 ft. at the base, making a total of 350,000 tons of salt. There still remained about 100,000 tons of salt in one reservoir, left behind as a bed for further operations since no more piling space was available.

During the 1948 pumping season, 210,000,000 gal. of brine was pumped into the reservoirs. The harvest, which commenced in November, is expected to exceed 500,000 tons of Glauber's salt.

Raw Glauber's salt is transferred from the stockpiles to a travelling hopper by means of power equipment, then fed as required onto a 24-in. belt conveyor which takes it 1,100 ft. to the processing plant and dumps it into a steel receiving bin. It is drawn off from the bottom of this bin by screw conveyors which feed it to the four Holland evaporators.

New-Design Evaporators

The Holland evaporators, as used at this plant were developed over a considerable period of time; they have been found to be extremely efficient. From the outside, they show only a steel box 10 ft. wide, 12 ft. high and 14 ft. long. They consist essentially of a casing so arranged that incoming gases do not come in contact with the walls or other parts of the evaporators. The evaporator is made of steel, preferably stainless steel, with agitators and a collecting mechanism. Two of them utilize exhaust heat from the two rotary dryers; the other two are fired direct, each having its own furnace. Two additional evaporators are now being constructed and should be in operation within the next three months.

The raw salt is fed into the evaporators, the amount being determined by the number of revolutions of a short-pitch screw conveyor. In the evaporator, this salt melts in its own water of crystallization. This results in the formation of a certain amount of anhydrous which drops to the bottom of the evaporator, while the brine portion is sprayed by means of rotating "beaters," so that the entire inside of the evaporating chamber is filled with a dense spray. The hot gases entering the evaporator, either as exhaust gases from rotary dryers or from direct-fired furnaces, pass through the evaporating chamber, transferring the heat to this finely dispersed brine. The result is a continuous concentration and precipitation of more anhydrous salt.

When the evaporators are fired directly from the furnace, gas inlet temperature is usually about 1,500 to 1,700 deg. F. and exhaust gas temperature is 160-170 deg. When exhaust gases from the rotary dryers are used, inlet temperature averages about 500 deg. (but may go as high as 550-600 deg.) while exhaust temperature is about 155 deg. These temperatures can be raised to suit operating conditions. This transfer of heat is done in the space of eight feet, which is the length of the evaporating chamber.

Experience has shown that use of an 80-ft. dryer without an evaporator will give an output of 45 tons of anhydrous sodium sulphate per day, but that a 60-ft. dryer with a Holland evaporator will yield about 80-90 tons of production daily. Fuel consumption, in this case, is 25-30 gal. of Bunker "C" oil per ton. Of the total work, about half is done in the rotary dryer and the balance in the evaporator.

An evaporator fired directly by furnace will give an output as high as 125 tons per day; fuel oil consumption is the same as for an 80-ft. dryer without an evaporator to utilize its exhaust gases.

Hanging Arch Furnaces

Furnaces used are a special design. They are known as the hanging-arch type and are provided by Bigelow-Liptak Corp. of Detroit. Efficiency of the furnaces in these operations has proved to be extremely high, since the heat that would ordinarily be lost by radiation is drawn into the furnace through louvers consisting of openings in the furnace brick. This in effect cools the brick and at the same time supplies air for secondary combustion. The bricks hang on a steel frame.

An air space of about 8 in. is placed between the outside of the fire brick and the common brick covering. This air is heated and recirculated to the burners. The roof of the furnace consists of bricks on cast-iron hangers hung separately; this takes care of expansion. Expansion joints filled with asbestos fiber are placed in various parts of the furnace, overcoming the difficulty experienced in the ordinary buck-stave type. Efficiency is so high that one can stand on top of the furnace in comfort.

Bunker "C" oil is delivered to the plant by tank car or tank truck and stored in two 33,000-gal. tanks. It is preheated before pumping and then is brought to a temperature so that it will be delivered to the Peabody burners at 190 deg. F. A 32,500-bbl. tank is now being erected for general storage purposes. This will be used to store fuel during the summer months, when there is a surplus available.

Anhydrous sodium sulphate from the Holland evaporators is put through an Oliver horizontal filter which reduces the moisture content to 10 percent. The semi-dry cake is fed into the two rotary dryers where the balance of the moisture is removed. The brine from the filters is pumped back to the evaporators. Dry cake from the rotary dryers is dumped into a screw conveyor, then elevated to a vibrating screen. Here the fines drop into another screw conveyor, while the coarse material is ground to proper size in a rod mill. The product, now uniform in size, is elevated to the top of two steel storage bins, each 40 ft. in diameter and 40 ft. high.

The Product Goes Out

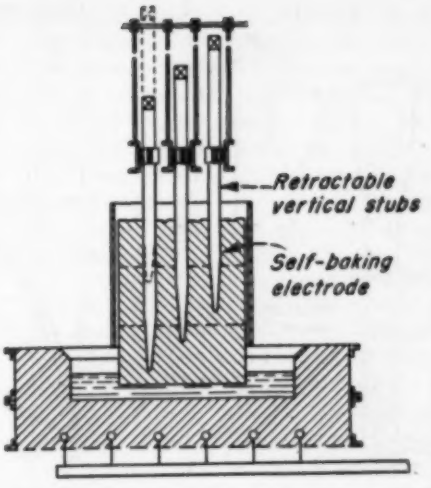
Salt cake, as dried sodium sulphate is known commercially, is shipped in bulk or in bags of 100 lb. loaded by a bagging machine. When bulk shipments are made, gates are opened in the bottom of the bins. The dry material flows into conveyors which drop it into the boot of a bucket elevator; this, in turn, drops it into a car loader.

The product from the Chaplin plant is shipped as far east as Bathurst, N. B., and as far south as Florida in the United States. Demands for the product come from South Africa, Belgium, Holland, Sweden, Finland and other countries. The product is of particularly high quality, averaging 98.5-99.5 percent. Major markets are the kraft paper and synthetic detergents industries. Secondary outlets: in stock feeds, as a mordant in dyeing, refining of copper and nickel ores, and other uses.

Results of a recent survey of salt cake consumed in the United States and Canada are shown in Table II. Although salt cake consumption by Canadian sulphate pulp mills is being rapidly increased from 106,500 tons in 1947 to an estimated 151,500 tons in 1949, there will probably still be about 148,000 tons of Canadian production available for export to the United States.

Modern Aluminum Cells

Newest development in the aluminum industry is the Söderberg self-baking electrode—with improved vertical stubs to support it.



F. C. Frary
Aluminum Co. of America
New Kensington, Pa.

EVER since the first development of electrolytic production of aluminum by Hall and Heroult, before 1890, there has been constant improvement in the types of cells used. The problem of heat loss from the molten baths of cryolite has been solved by allowing a solid crust of a mixture of frozen bath and aluminum oxide to form on the top of the bath. "Anode effect," caused when the aluminum oxide content of the bath drops too low and the bath does not wet the anode, has been minimized by operating many cells in series.

The biggest recent developments in aluminum cell construction have been in the development of new type anodes. Early cells all had carbon anodes made of prebaked carbon, the source of which was usually petroleum or pitch coke to minimize ash content. The newest cells are modifications of the Söderberg "self-baking" electrode, devoloped originally for use in other cells and furnaces, such as those in which calcium carbide is made.

Individual experimental cells were operated by producers both in this country and abroad between 20 and 25 years ago, and the first commercial operation of a full line of aluminum cells with Söderberg anodes began in 1927 at the Alcoa, Tenn., plant of the Aluminum Co. of America. The anodes used here were cylindrical, about 7 ft. in diameter and 5–6 ft. high, encased in a shell of sheet aluminum and supported by current-carrying clamps attached to a clamping ring. The cells used were circular, of such size as to give a bath cavity of about 2 ft. greater in diameter than the anode. They operated on a current of between 25,000 and 30,000 amp. The bottom end of the anode was baked electrically before the cell was started and then carbon paste (a suitable mixture of petroleum coke, pitch, and tar) was fed into the top of the shell and gradually baked *in situ* by the heat of the cell itself. The anode bottom remained quite flat in operation and the central hole provided in the anode for the discharge of gas was found to be unnecessary.

The clamps were cumbersome and unsatisfactory both as a supporting means and as a current-carrying means. They were replaced by other mechanical means of supporting the anode, while slightly conical steel stubs, about 3 in. in diameter and 2 ft. long, driven into the soft paste through the aluminum shell and subsequently connected to the anode bus with copper flexible cable, served to introduce the current to the anodes. Later, rectangular anodes, supported by a framework of steel channel "logs," were developed and found suitable for use in rectangular cells. The latter are more convenient and economical than circular ones.

Simplified Construction

In the newest type of Söderberg anode [1, 2] the construction of the carrying device is simplified and the labor in connection with the anode greatly reduced by the use of vertical instead of horizontal stubs. These vertical stubs projecting down through the carbon paste into the baked tip of the anode support its weight and, at the same time, carry the current. They are set at different levels and, at appropriate times, those which extend the farthest into the anode and have come too close to the molten bath are pulled out by a stub-puller carried on a crane. A few pounds of fresh carbon paste are placed in the hole thus left and the stub is driven back again to a position a foot or more above its original position. When the new paste has been baked into a solid mass of carbon by the heat from the cell, the stub is again ready to carry its share of the mechanical and electrical load. While only a limited amount of commercial experience has been had with this type of anode, the results are quite encouraging and the development seems to be a promising one.

At suitable intervals (e.g., every second or third day) the molten metal which has been deposited must be removed from the electrolytic cell. More modern methods of metal removal include siphoning[3] or pumping[4] the molten metal into a suitable crucible from which it can be poured into pigs.

The steadily increasing demand for aluminum and the sharpness of its competition with other metals have emphasized the necessity of improvements which will reduce costs and selling prices. Active developments going on all over the world in this young and vigorous metal industry will steadily improve the competitive position of aluminum in modern metals technology.

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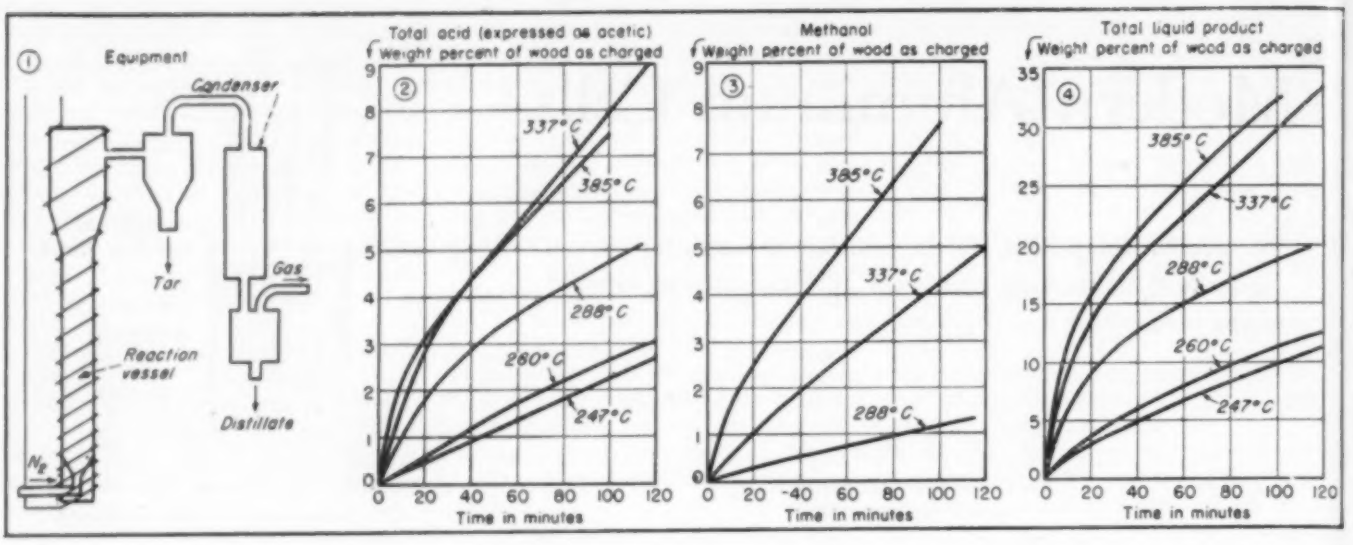

Distillation of Fluidized Hardwood

In this new role, fluidization promises higher yields, more rapid distillation, continuous processing. Above are test equipment and the encouraging results.

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USE OF the fluidized-powder technique in wood distillation has great promise. Hardwood has been successfully distilled in recent laboratory experiments at Georgia Institute of Technology. So far all experiments have been with hardwood. But it is expected that the same method could be used, with modifications, to distill pine and pine stumps for turpentine and rosin. It could also be employed in the distillation of cedar for cedar oil and in other similar processes.

In hardwood distillation by the fluidized-powder technique, sawdust or powdered wood is heated while it is suspended in a stream of hot non-oxidizing gas. A conventional recovery system separates tar, acetic acid, methanol and other products from the outlet gas. The inlet gas may be secured from combustion and recycle of gas leaving the recovery system. Alternatively, it may be obtained by manufacturing producer gas from some of the charcoal product. A unit would probably operate continuously, following practice in the petroleum industry. Two stages might well be employed: the first to distill most of the volatile matter at a relatively low temperature with a minimum of thermal decomposition of acid, alcohol and tar; and the second, operating at a higher temperature, to strip residual volatile matter from the charcoal.

Economic success of the process will depend on an outlet for the powdered charcoal. The charcoal accounts for about one-third of the total weight of the wood. This charcoal is a promising raw material for activated carbon. Activation could be done conveniently by the fluidized-powder technique. And the potential market for activated carbon is considerable.

In preliminary experiments, red-oak dust was fluidized in nitrogen gas in a 4-ft. column of standard 2-in. pipe. First runs, in which the dust and the reactor were initially at room temperature and then heated to effect carbonization, were disappointing. As carbonization temperatures were reached, the particles of dust stuck together and clogged the reactor. A way to avoid clogging was found. The cold charge is introduced into a unit already at distillation temperature. Thus the charge is heated rapidly. Once this procedure was adopted, a number of successful runs were made, proving that the method works. Yields are as good as or better than yields obtained in currently used processes. Rates of distillation are far higher than those reported for other methods.

Figure 1 is a sketch of the apparatus. All runs were batch runs at constant temperature. Since the work was preliminary, a complete analysis of the gas, pyroligneous liquor and charcoal was not attempted. Ordinary cylinder nitrogen, without further purification, was employed. During each run, rate of evolution of gas and pyroligneous liquor was measured periodically. At the end of each run, charcoal and tar were weighed to determine yields. At intervals during a run, samples of the gas were analyzed in a standard Orsat apparatus, and samples of the pyroligneous liquor were analyzed for methanol and total acid. In both of the latter analyses the procedure of Othmer and his associates[a] was followed. Yields thus obtained were corrected by adding the amounts of acid and methanol estimated to be in the gas vented from the pyroligneous liquor receiver. Since all runs were ended before liquid stopped flowing into the condensate receiver, it was assumed that gas vented from the

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receiver was saturated with water, acetic acid and methanol throughout the runs. Partial pressures of acid and methanol were estimated from the data of Ferguson and Funnell,[1] Wrewsky[8] and Kahlbaum[2] on aqueous solutions. Partial pressure of the water vapor was calculated by applying Raoult's Law.

Over-all balance on a typical run is given in the table. Yields of acid, methanol and total distillate, each as a function of time and temperature, are presented in Figs. 2, 3 and 4 respectively. From these data, several conclusions can be drawn.

First of all, it is interesting to compare the yields with figures reported in the literature. For example, the table shows that yields of acetic acid and methanol from a run of 100 min. at 385 deg. C. are each 8.1 percent by weight (on a basis of dry wood). These figures compare with yields of 6.82 percent for total acid and 2.25 percent for methanol, reported by Merritt and White[5] for steam distillation of red oak to a final temperature of 400 deg. C. under laboratory conditions. The same investigators report yields of 4.70 percent and 2.2 percent for total acid and methanol, respectively, in a commercial operation on the same wood. It is a known fact that yields in hardwood distillation are improved by proper temperature control. Therefore, it is presumed that the better yields obtained by Merritt and White in the laboratory, as compared to the plant, are primarily due to the closer temperature control maintained in the small-scale unit under laboratory conditions. Indications are that fluidized-powder operation gives higher yields than found by Merritt and White. Presumably, this is because of the exceptional uniformity of temperature and the absence of localized overheating that characterize a fluidized bed of solids. The significance of these facts will be appreciated when it is recalled that the fluidized-powder technique makes it possible to secure and to maintain temperature control not only on a small scale but just as well on a large scale.

Second point of interest is the rate characteristics of the process. These can be seen by looking at Figs. 2, 3 and 4. After an initial surge, the rate of evolution of volatile products drops to a lower value. But thereafter distillation continues at a rate that decreases remarkably slowly. By continuing the distillation for longer periods than were employed in the experiments it may be possible to get even higher yields.

It is not possible to tell from the data if the rate of distillation at a given temperature is significantly higher in a fluidized bed than it is in a conventional kiln. But is is clear that the high heat-transfer rates secured in the fluidized bed make it possible to heat all the wood to carbonization temperatures almost instantaneously. And the distillation can be completed in a much shorter overall time than it takes for a cycle in an ordinary kiln. Thus, in the run at 385 deg. C., almost a third of the total acid yield was evolved within 10 min. Total length of the run was under 2 hr. In contrast, Klar[4] reports a time of 10 to 12 hr. for commercial distillations; Merritt and White[5] employ a 12-hr. cycle; and Read[7] mentions 16- to 30-hr. cycles.

For estimating the size of a unit required for a given production, it is important to know how much material can be suspended in a unit volume of apparatus without difficulties due to a gas-lift effect. In the apparatus used, the maximum density was about 10 lb. of charge per cubic foot of reactor volume. Assuming an average residence time of 2 hr. in a continuous unit, the reactor volume needed to handle one cord of dry wood (4,000 lb.) in a 24-hr. day would be (4,000) (2)/(10)(24) or 33 cu. ft.

Gas supply depends on the gas velocities needed to suspend the sawdust. While this obviously depends on the particle size, the concentration of material within the reactor volume and other factors, it was found under the conditions employed that a velocity of approximately 0.8 fps., calculated on the basis of the cross-section of the vertical pipe and the operating temperature, gave smooth operation. As stoichiometric calculations show, the amount of gas needed to maintain a velocity of 0.8 fps. in an apparatus of reasonable dimensions can be obtained by the manufacture of producer gas from only part of the charcoal produced. Another way of getting this gas is to recycle a moderate amount of the gas obtained from combustion of the gaseous distillation products after removal of valuable constituents. At 385 deg. C., the dry, acid-, methanol- and nitrogen-free gas is chiefly CO and CO_2 in the molal ratio of about 2 to 1.

For a large-scale unit, continuous operation would probably be better than batch operation. Batch operation was employed in the laboratory experiments. Performance of a continuous unit can be predicted from the batch data through use of Kalbach's[3] mathematical methods.

Kalbach emphasizes that batch operations are best for laboratory experiments with the fluidized-powder technique. First of all, total laboratory work is reduced. For data on a single batch run can be used to predict results of continuous runs at a number of different average retention times. In the second place, batch experiments provide an unexcelled means of studying isothermal reaction mechanisms. Thus data presented in this article are the first information reported in the literature on progress in hardwood distillation under essentially isothermal conditions, with all particles in the mixture at any moment exposed to a known temperature for a known time.

The preliminary data and calculations that have been discussed in this article seem to justify the conclusion that the fluidized-powder technique has important possibilities as a method of distilling hardwood and perhaps other types of wood as well. Plans are being made to continue work on the process at Georgia Institute of Technology.

It was W. K. Lewis who originally suggested the experiments reported in this article.

Over-All Balance on Run at 385 Deg. C.

Length of run, min.	100
Charge (containing 6.4% moisture), gm.	400
Nitrogen input, gm. mols	73.8
Charcoal, gm.	120
Tar, gm.	26
Distillate collected in receiver, gm.	56.0
Total acid, expressed as acetic, gm.	9.8
Methanol, gm.	4.2
Gas vented from receiver, gm.	85.1
mols	
Water vapor, gm. mols	1.52
Acetic acid, gm. mols	0.34
Methanol, gm. mols	0.82
Dry, acid-, methanol-, nitrogen-free gas, gm. mols (85.1—73.8—1.52—0.34—0.82 =8.6)	8.6
Water vapor, gm.	27.4
Acetic acid, gm.	20.4
Methanol, gm.	26.8
Dry, acid-, methanol-, nitrogen-free gas, gm. (Calculated from charge less liquid and solid products: 400—120—26—56.0—27.4 —20.4—26.3=124)	124
Yields, wt. % of dry charge	
Total acid, expressed as acetic.	8.1
Methanol	8.1
Charcoal	32.0
Tar	6.9
Gas (calculated from charge less liquid and solid products).	33

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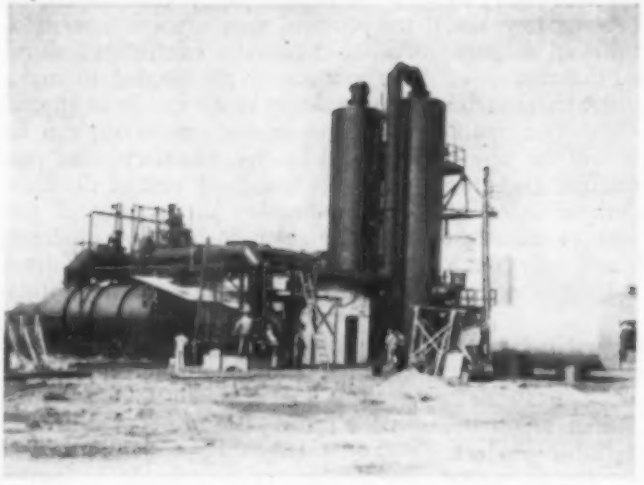
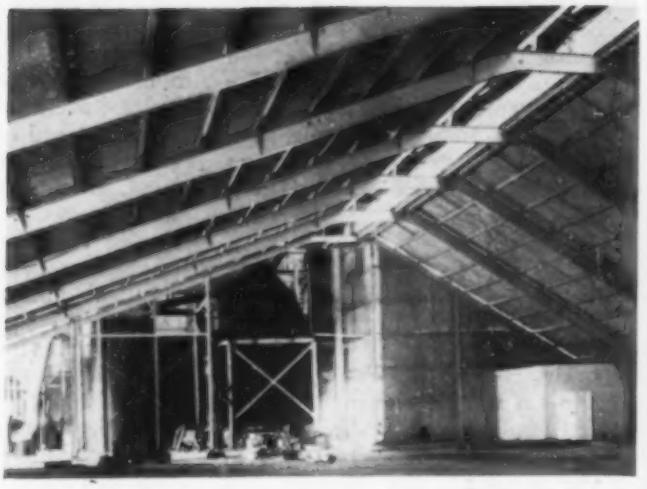


OPEN-AIR EQUIPMENT comprises the principal part of this contact sulphuric acid unit.



CONTINUOUS PROCESSING is aided by the use of a belt conveyor to carry superphosphate through monitor roof.

Naco Goes Modern

Naco Fertilizer Co.'s new superphosphate plant combines latest ideas in unhoused equipment, mechanical handling and "assembly line" processing.

James A. Lee
Managing Editor
Chemical Engineering

IN A NEW Charleston plant, Naco Fertilizer Co., a subsidiary of W. R. Grace & Co., makes its own sulphuric acid and combines it with phosphate rock dust to get superphosphate. Some acid goes to local consumers; most is used to make superphosphate. Some superphosphate is converted by standard methods to ammoniated superphosphate for export; most goes by conveyor belt to Naco's fertilizer mixing plant (also new).

Acid Plant

Engineers from the Chemical Construction Corp. of New York designed, engineered and built the acid plant, the first in South Carolina to use the contact process. For several months it has been turning out 20 tons a day over its rated capacity of 100 tons of 100 percent acid, as 60 deg. Be., per 24 hr. A byproduct is 2,600 lb. (gross) of steam for every 2,000 lb. of acid. Heats of combustion in the furnace and of reaction in the converters produce it. They've made provisions to withdraw 98 and 93 percent acid from the system as required. All the principal equipment is out-of-doors.

While a part of the acid is sold to local consumers, most of it is piped to the phosphate plant where it is used to make superphosphate. In turn part of the superphosphate is converted to ammoniated superphosphate for export. Standard methods are used here. The superphosphate is conveyed to the fertilizer mixing department where it is used in preparing mixed fertilizers. Like the acid plant, the superphosphate and fertilizer plants are very modern having been built only a few months ago.

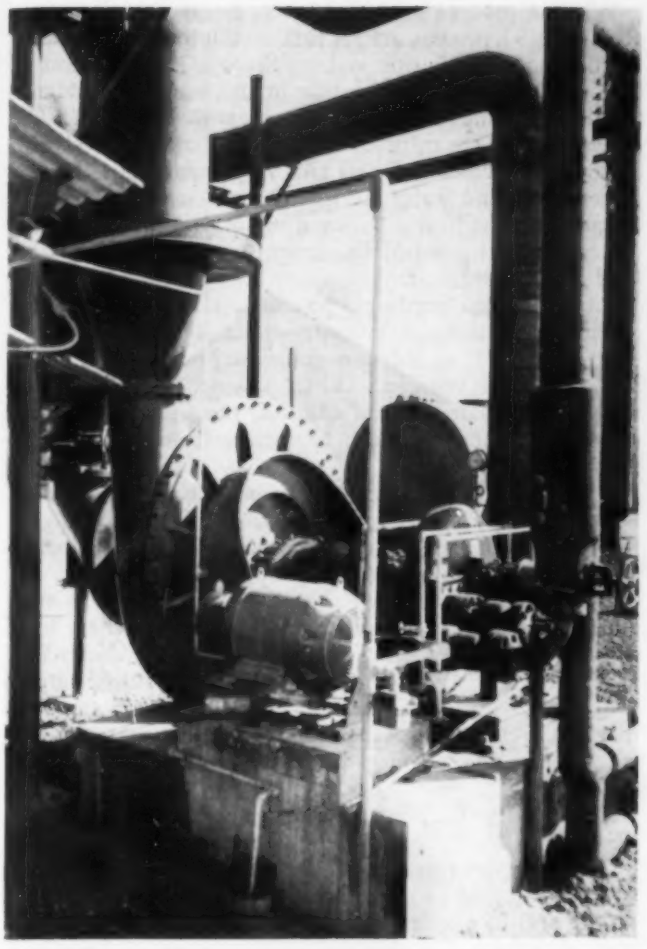
Acid Making

Sulphur is received in box cars from mines in Texas. Here it is unloaded by means of a Payloader from a concrete ramp either directly to storage or into the melting pit. Two compartments in the sulphur melting pit permit the cleaning of one while the other is in use. Cost of unloading sulphur amounts to 10 to 15 c. per ton. It is the grade known in this country as "bright" sulphur and is unscreened.

In the pit sulphur is melted by means of steam supplied by waste heat boilers to steel pipe melting coils. It is maintained in the molten state in the pit for about 72 hr. This permits the coarser impurities to settle out. The molten sulphur is heated slightly below 275 deg. F., the temperature corresponding to minimum viscosity in order to permit proper atomization in the sulphur furnace. Above this temperature sulphur becomes stiff and tacky and will tend to clog the sulphur gun.

The molten sulphur is pumped into the furnace by means of a steam turbine driven centrifugal sulphur pump. The volume of sulphur is controlled by regulating the stream pressure at the turbine by means of a pressure reducing valve and a steam flow control valve.

Air required for combustion is drawn from the atmosphere through an air filter into the drying tower. This



INCREASED MECHANIZATION is especially apparent in this electric motor (left) used to start contact plant operations and in the use of screw conveyors to carry incoming rock to the bucket elevator (right).

prevents dirt and rubbish from entering the tower. The tower is steel with an acid proof masonry lining. Strong acid is circulated over this drying tower and removes moisture from the air. The heat generated by dilution of the acid with water vapor is removed in cast iron cooler sections. The acid is pumped over the drying tower and through the coolers by a self-priming motor-driven acid pump.

Air is propelled through the system by means of a steam turbine-driven centrifugal blower with turbine supplying exhaust steam to heat the boiler feed water in the feed water heater. There is a considerable amount of excess exhaust steam available for other uses. The blower is located after the drying tower.

Beginning Operations

A unique feature used for the first time in any contact plant as far as we know is the set up for starting operations. Since the blower is driven by a steam turbine and steam becomes available only after heat is developed in the furnace, electric power must be used to drive the blower at the outset. In this plant a V-belt sheave is provided on the shaft between the blower and the steam turbine. An electric motor connected to this shaft with V-belts drives the blower until sufficient steam is produced to operate the turbine.

Sulphur from the melting pit is sprayed through a Chemico sulphur gun into the furnace where it is burned in pre-dried air to form sulphur dioxide. Hot combustion gases leaving the furnace pass through a waste heat boiler operated at 220-250-lb. pressure in order to maintain high water temperature essential for the purpose of avoiding acid condensation. Here the gases are cooled to 650 deg. F. This temperature is controlled by means of the bypass lines around the furnace and boiler. Bypassing a large quantity of cold air raises the furnace temperature and lowers the temperatures of the gases entering the converters and vice versa. Bypassing a large volume of hot gases around the boiler raises the converter temperature.

Piping Arrangement

Reasons for this arrangement of piping are: (1) to protect the steam boiler from too low an exit temperature if the plant should be operated at reduced load, and (2) to permit proper temperature regulation of the gases entering the converter.

The water level in the boiler drum is automatically controlled by means of a boiler feed water regulator. A bypass is provided around this regulator to permit manual operation if required. Treated feedwater is furnished to the heater where it is heated to the proper temperature for entering the boiler and dissolved oxygen is removed. This heater is operated at a temperature corresponding to the boiling point at the pressure inside of the heater in order to assure complete deaeration of the water. This hot water is fed by means of the feedwater pump into an economizer, where waste heat from the gases leaving the converter system raises the temperature to boiler water temperature. From the economizer the heater water flows direct to the boiler drum. Equipment is provided to permit addition of

sulphite, for further removal of oxygen from the water, and phosphates, (for conditioning boiler scale, etc.) as required.

After leaving the boiler the gas flows into a single tray gas filter. This filter is installed to remove any ash from the sulphur which has not been removed in the settling pit together with scale, etc. This filter is cleaned periodically, that is, whenever the pressure drop across the filter indicates that such cleaning is necessary.

Converter System

The converter system consists of primary and secondary tray-type converters with intermediate heat exchanger. Flow through the converter is down-draft through successive layers of catalyst.

The SO_2 gas leaving the boiler is partially cooled by means of air bypassing the furnace and boiler. After filtering this gas enters the heat exchanger where its temperature is raised to about 800 deg. F., the proper temperature for entering the first layer of catalyst. During this heating operation, it also cools the temperature of the gas entering the secondary converter. The gas passes through two layers of mass in the primary converter where partial conversion takes place at a rapid rate and the gas temperature rises to 1,050-1,100 deg. F. It is then cooled in the heat exchanger to about 800 deg. F. before entering the first layer of mass in the secondary converter. Further conversion takes place with a small additional rise in temperature. In order to improve over-all conversion of the installation, the gas is further cooled after leaving the first layer of mass in the secondary converter and before it enters the last layer of mass. This cooling is controlled by the amount of air permitted to pass along the shell of the secondary converter and is controlled by adjusting air louvers, externally operated.

Hot gases leaving the second converter must be cooled before they enter the absorption tower. This cooling is accomplished in a steam economizer. The gas temperature leaving the economizer is above 450 deg. F.

The SO_3 is removed from the gases by scrubbing with 98 to 99 percent sulphuric acid in a tower which is identical in design with the brick-lined steel drying tower. The heat generated in the absorption tower is removed by cooling the circulating acid in cast iron cooler sections. Cooling water is distributed over these sections which are identical in design with those used on the drying tower. Acid is pumped over the tower and through the coolers by means of a LaBour self-priming acid pump.

It is important that the acid circulating over the drying tower and absorption tower be maintained at the optimum strengths. Since the acid circulating over the drying tower removes the moisture from the air, it tends to lose strength and increase in volume. In the other tower the absorption of SO_3 tends to increase the strength of the acid. To compensate for these changes a small stream of acid from the absorption system is continuously fed into the drying tower circulating system and acid from the drying tower is fed into the absorption system. Thus part of the water required to combine with the SO_3 is provided by the moisture in the air. Additional water required to maintain the acid at its optimum absorption strength is provided from other sources of fresh water.

Stack gases leaving the absorption tower contain the nitrogen carried into the drying tower as air, together with excess oxygen, unconverted SO_2 and very slight traces of acid mist.

If 93 or 98 percent acid is desired, it is drawn off the acid circulating lines and flows to storage. It is stored in steel tanks until required for shipment or use in superphosphate plant.

When a product acid of 60 deg. Be. is desired the 98 percent or 93 percent acid is further diluted with water in the 60 deg. Be. diluting system. Since a large amount of heat is generated when diluting in this range, coolers and circulating pumps are provided to remove this heat. The cooler sections are made of cast iron and are identical with those used in cooling the 93 and 98 percent acids. The 98 percent acid and water are mixed with circulated 60 deg. Be. acid and the heat is removed by spraying water over the coolers. Acid is pumped to storage to maintain a constant level in the diluting tank.

Processing temperatures, pressures, acid strengths, and the like, are measured by instruments. These instruments are used only for recording or indicating purposes. No automatic control is required. When provided with a constant feed of raw materials and utilities, the process functions smoothly without recourse to such instruments or automatic controls.

A 1,500 ton steel storage tank is provided for the 60 deg. Be. acid. This was necessary because the plant was designed to produce more acid than would be required for production of superphosphate in the company's own plant. The acid over and above that required by this plant is sold to other chemical producers in this area. The need for pure, high-strength acid is becoming greater each year in the face of southern industrial expansion. This storage tank permits elasticity of operations in that the superphosphate plant may be shut down for periods of as great as two weeks without the necessity for discontinuing the production of acid.

The 60 deg. Be. acid is pumped to the superphosphate plant by a Worthite centrifugal pump where it is further diluted to approximately 56 deg. This system is not provided with coolers for the heat of dilution is used to heat up the acid to a temperature suitable for the production of superphosphate. The diluting system consists of three lead-lined steel tanks supported by concrete piers, and air blowers to agitate acid in the tanks, and Worthite pumps to transfer the acid. This dilution system is operated by adding acid and water continuously and observing the hydrometer reading and temperature rise in the mixing boot.

The final strength of the acid is determined by the superintendent of the acidulating department or the chemist. The required strength depends upon the fineness and the composition of the phosphate rock to be treated. It has been found that finely ground rock (70 percent through 200 mesh screen), well aerated in process from the grinding to the Raymond mill, reacts efficiently with an acid of 56 deg. Be. (corrected to 60 deg. F.) and an ambient temperature approaching 150 deg. F. permits a desirable mass in the den. This mass is pitted with small air holes and is of proper consistency for cutting, aeration and storage.

Superphosphate Plant

Phosphate rock from Florida has a total phosphoric acid content of 33.67 percent, equivalent bone phosphate of lime (BPL) of 73.55 percent. It is received at the plant in either box cars or hopper bottom cars. The former are emptied by means of a motor-driven power shovel. The contents of the latter type of car discharge directly into a screw conveyor which carries the contents into the hopper just ahead of the boot of the bucket elevator. This elevator carries the rock to a belt conveyor from which it is discharged to rock storage.

Two types of phosphate rock are used: (1) concentrates developed from flotation of low-grade rock, and (2) pebble rock. Concentrates are as fine as sand but contain no dust. Since these concentrates are nearly all of the same size

they do not permit as efficient operation in grinding as do the pebbles. Concentrates and pebbles are transferred from storage by a screw conveyor in the floor, under the rock pile, to a hopper, a bucket elevator, and then to a storage bin just above the feed to the Raymond mill. This mill, which is a compact, air-swept, attrition type grinding unit, operates in a very efficient manner and has given little or no trouble since the plant began operating early in September 1947. The feed of the mill is automatic and controlled by a nominal air pressure differential which by means of a bellows, controls the input of rock to be ground. The ground dust is blown by the mill unit into a cyclone collector. By means of counterweight, vanes drop it into the silo. The ground rock dust because of its aeration and relatively high temperature has a very low angle of repose and flows freely through a screw conveyor at the bottom of the silo. A bucket elevator conveys the material to another screw conveyor at a height of 40 ft. above the bottom screw. The ground dust is then conveyed by the top screw conveyor to a small storage hopper equipped with a Mercoid level switch which stops the flow of material at a desired level.

Measuring and Mixing

Dust is drawn from the storage hopper at this point into a carefully calibrated weighing hopper and the desired weight of rock is held in this hopper until the operator is ready to dump it into the two-ton Pratt mixer. In the meantime, the 56 Be. acid is likewise weighed in a weighing tank and held in readiness for its release into the mixer. The Pratt mixer is a revolving cast iron pan with a stationary cast iron cover. There are two shafts extending vertically from the horizontal drive shaft into the mixer, each revolves counter to the other. Both are equipped with plow points or mixer heads. After mixing the contents are dumped by means of a plunger in the center of the mixer. This plunger is manually operated by means of the lever principle by the man who weighs the dust. The pan mixer revolves in a clockwise manner. Two stationary scraper blades lower into the mixer with the raising of the plunger. These blades force the mixed material to flow through the hole left by raising the plunger.

Charge in the mix is composed of about a half-ton of rock and a nearly equal weight of acid. The soupy mixture is stirred vigorously for about one minute. The tricalcium phosphate is converted by the acid at 110 deg. F. to monocalcium phosphate. Much of the fluoride in the rock reacts with the sulphuric acid to form hydrofluoric acid. This latter acid reacts with silicate to form SiF_4.

The den proper is composed of a flat car, maintained on six sets of small railroad-type wheels and constructed of a concrete floor mounted over the axles of the wheels, a concrete back, two separately suspended wooden sides and a sliding front door of wood which can be raised or lowered by means of a motor-driven hoist. The individual batches weighing approximately 2,400 lb. drop from the pan mixer to the enclosed den flood at a rate of approximately 35 tons in 40 minutes. A setting period is then allowed of some 5 to 15 minutes after which the screw jacks holding the side doors are released and the front door slowly raised by means of the hoist. The den at this point is ready to move forward into revolving cutter knives and discharge into a bucket elevator. This carries the material to the belt conveyor, which in turn conveys it to superphosphate storage. The den moves forward by means of a motor-driven gear reduction unit at a speed of 16 rpm. on the wheel shaft, slowly forcing the block of freshly made superphosphate into the revolving cutter knives.

During the mixing operations prior to cutting the block; a considerable volume of fluoride gases is evolved from the reaction in the pan and also from the den. These gases are drawn off of the pan by means of a rubber-coated blower and a four-tower condensing and cooling system. Water is sprayed into the first three of the wood towers, forming an acid condensate. This is recirculated by pumps which feed the sprays until it reaches a strength justifying discard.

Adequate ventilation and aeration is most necessary for the rapid curing and conditioning of the superphosphate from the time the den door is raised until the material is ready for shipping. A 50-ft. stack is provided over the cutter bay section of the den in order to draw off escaping residue fluoride gases and moisture during the cutting operation. As the material drops into the boot of the bucket elevator, just off of the cutter, it passes into a further aerated area due to the installation of a 12-ft. stack on the top of the "up" side of the bucket elevator. The material is then discharged to a rapidly moving belt conveyor where it passes through a monitor roof which is so constructed that the material is well aerated as it passes along on the belt. The superphosphate is further aerated when it is plowed, or scraped off of the belt, and allowed to fall from a point near the roof to the top of the superphosphate pile on the floor. When it reaches the pile the freshly manufactured superphosphate is sufficiently cool so that it may be tightly clasped in the hand without discomfort.

Superphosphate is allowed to remain on the floor, until it analyzes 19 to 20 percent available phosphoric acid and is ready to be used or shipped. This usually occurs in about two weeks. Much of the superphosphate is consumed in the fertilizer building. This part of the material is transferred from the superphosphate plant to the fertilizer mixing plant by a belt conveyor.

Material to be sold is moved from the storage pile to the shipping unit by means of a dragline scraper which has been found to eliminate a considerable number of man-hours of labor. Here it can be weighed or not as desired. A standby Payloader assists in keeping the pile trimmed and in cleaning up the floor. The Payloader is a small mobile unit, equipped with a 500-lb. capacity moveable bucket in front. It can be driven into a broken pile of superphosphate and, by proper manipulation of the bucket, pick up a load of approximately 500 lb., back away, and deliver this material to any desired area such as a weighing hopper or boot elevator.

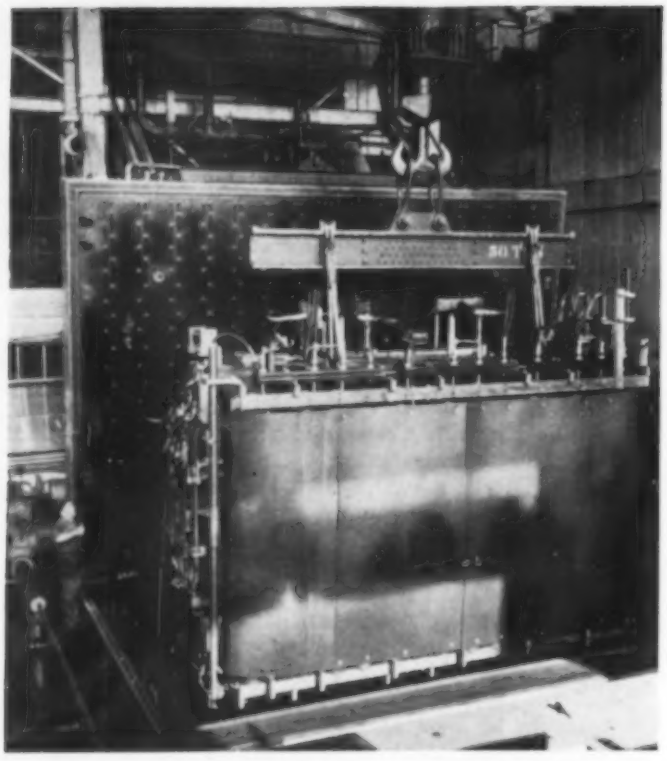
Shipping Operations

The operations of the shipping unit include provisions for the ammoniation of the superphosphate, elevating it to a screen from which it passes into a rotary "cement type" mixer into which is forced a predetermined quantity of a nitrogen solution. The ammoniated material is then discharged from the mixer into a bucket elevator from which it is discharged on to a belt conveyor, and stored in another building. Here it is conditioned before shipment.

In the shipping unit provisions are provided for bagging superphosphate and ammoniated superphosphate through a valve-type bagging machine making use of multi-ply valve-type paper bags. These machines can bag the material at a rate of 30 tons per hour. The bagged material is then loaded into box cars. Provisions are also made, by means of a swivel-type loader, to discharge either superphosphate or ammoniated superphosphate in bulk into a box car.

The continued maintenance of a crew of men in charge of up-keep is of considerable importance to the uninterrupted manufacture not only of acid but also superphosphate.

The writer wishes to acknowledge the assistance of Mr. George A. Zeigler, manager of the Chemical Division, Naco Fertilizer Co., Charleston.



This vacuum-bake tank for transformer drying is only one application of improved process engineering.

Chemical Engineering in

Electrical Manufacturing

Unsuspected opportunities lie in insulation, filtration, byproduct recovery, and other unit operations.

N. R. Maleady
General Electric Co.
Pittsfield, Mass.

CHEMICAL engineers are rapidly becoming an important asset to the electrical manufacturing industries through interpretation and application of their technology to production problems.

Electrical manufacturers are concerned primarily with the production of suitable apparatus for the generation and transmission of power. In the manufacture of motors, generators, transformers and allied products certain fundamental problems are common to all. Far reaching developments and general advances in design of equipment have progressed to the point where such factors as insulation and finishes are of prime importance, and can mean the success or failure of an otherwise perfect electrical development. In addition, insulation, finishes, and other chemical products are needed in huge quantities in formulation as exact as those made in small laboratory lots. The chemist can create these compounds, but a chemical engineer is required to develop them and put them into actual production. Nothing illustrates that point any better than the basic distribution and power transformer.

A transformer is composed of many basic elements, upon which its characteristics, performance and life depend. One of the more important elements of this unit is its copper wire, which forms approximately 12 percent by weight of the complete units. This must be insulated from itself and from adjacent structures. In many designs resins or wire enamel provide this important function.

When wire enamel or resin is applied as a solution, a suitable solvent must be found. Methods for maintaining a constant viscosity of the solution must be devised, as well as the mechanical equipment to provide the necessary multiple coats of resin and to cure at the proper temperature between dips. A typical wire enameling machine has a drive, curing oven, and control instruments. Similarly, when the resin is applied in solventless, molten form, suitable dies and preheaters must be used for the extrusion of the material on the moving wire. In either case, the final cure requires the use of a multipass oven having accurate temperature control with a temperature distribution peculiar to the type of work. That is application work, one vital chemical engineering function.

Insulation

A second major component in the effectiveness of a typical transformer is the cellulosic insulation, in its variety of forms, used to separate metal conducting parts. The cylinder on which the wire is wound is composed of continuously wound paper, bound together by suitable impregnants and adhesives. Control of these materials and the mechanics of the tube rolling presents a challenge to the ingenuity of the chemical engineer, and typifies another major chemical engineering function.

Modifications of the paper and adhesives, as well as the method of application, are resulting in a stronger cylinder, both electrically and mechanically, and illustrate another function—development. In addition, insulation takes many other forms, including insulating collars, spacers, channels, blocks and panels, to mention a few, all of which must be fabricated and controlled under the eye of the engineer.

Varnish

A third component, providing both insulation and mechanical strength, is the insulating varnish used to treat component parts and assembled units. The chemical engineer must know and recognize the distinct properties of each varnish in order to be sure it fits the particular application.

Maintenance of these insulating varnishes in good working condition presents a problem of considerable importance. Viscosity of the material must be maintained within certain

limits and its electrical properties must be held at a high level through proper periodic filtration.

Dielectrics

The fourth component in the manufacture of transformers is the dielectric liquid used for insulating and cooling. Included in this group are the highly refined mineral oils and the newer non-flammable askarels. As these materials are received they must be filtered before use to remove certain impurities, including water. In many cases, one or two, or more, components must be blended and mixed to provide the necessary properties. In many types of units, the dielectric used must also be entirely free of air. This deaeration process reduces the air content from 6 or 8 percent to less than 0.5 percent. The degree of the deaeration must be kept uniform and high.

An even more important phase of the work of the chemical engineer in transformer manufacture is the processing of assembled finished transformers. When the insulated wire has been wound about the cylinder, the unit is ready for final treatment, which in many cases increases the mechanical strength, and raises the electrical strength to values expected by the designer. The need for increasing the electrical strength is due to the large percentage of water present at this stage of manufacture in the cellulose insulation.

This water may be removed by a number of methods. The fastest and most effective method is to apply heat to the unit under vacuum. By proper chemical engineering design, this process has been shortened and improved by using a vacuum bake tank. This provides rapid heating of units through air circulation, with removal of the absorbed water by the application of vacuum. The whole process results in the removal of practically all of the absorbed moisture with appropriate shrinkage of the cellulosic parts. Additional strength may be given to the coil by immersing the whole assembly into suitable insulating varnishes, which, when cured, bind the components into a unit.

Following varnish treatment, these separate coils of wire are assembled and mounted on suitable laminated iron cores. In spite of its varnish processing, the insulation, during this period of handling, re-absorbs moisture from the air. This water constitutes a real threat to the electrical strength of the finished transformer and must be completely removed. Chemical engineers developed the most efficient method thus far—the combination of hot air baking and vacuum. By this process, the diffusion of water from the cellulose is speeded.

When final drying has been completed, the unit is free of both moisture and air and the necessary dielectric fluid is run into the treating tank to completely immerse the coils. This provides a greater barrier to the adsorption of water and allows the units to be handled before placing in their own casings.

In the manufacture of electrical equipment, much of the work involving the development of new methods and application of new products falls to the chemical engineers. Pilot plant equipment, resembling its counterpart in the factory, permits the study of factory problems on a controlled scale. Many of the processes previously outlined have been developed in this way. For instance, in the drying of small transformers, it has been the aim to develop a drying method both short and continuous, as opposed to the older batch method. To achieve this goal, small pilot plant equipment was set up for studying drying rates in hot air and under vacuum. By careful extrapolation of these pilot plant findings, it was possible to design equipment to provide continuous drying. This represented an important forward step, resulting in a considerably more uniform and reliable transformer and adding many years to its operating life.

Special Chemicals

Many times in the course of manufacturing electrical products it is necessary to obtain small quantities of specialized chemicals for definite limited applications. Included in these are such materials as special polymers for film and impregnating compounds, special impregnating oils, etc. To make possible the manufacture of such specialty items a versatile pilot plant had to be established. This was done to prepare certain new dielectric materials. Included in the equipment were glass lined reaction and washing kettles, distillation columns, high pressure reduction units for work at 75-100 atm. and catalytic reactors for vapor-phase reactions. With this equipment it was then possible to produce nearly any type of material. Many monomers were produced and evaluated; the more promising materials have been turned into regular production.

New materials must be evaluated by construction of test units. With these samples the advantages and disadvantages of a formulation can be determined on a practical scale and necessary preliminary changes made. The application of new insulating varnishes to cellulose insulation is a problem which requires considerable attention. To meet this demand, versatile impregnating equipment must be set up for product evaluation. This equipment includes the necessary mixing and storage tanks for varnishes and impregnating tanks built to operate under high vacuum or high pressure. Sample coils can then be impregnated under varying conditions with varying concentration of materials to determine the best possible insulation strength of various products. In using the equipment, information is also gathered on proper methods of handling a given varnish as well as its life in actual use. Problems of filtering can be worked out on a small scale and design data developed for use in factory installations.

Trends

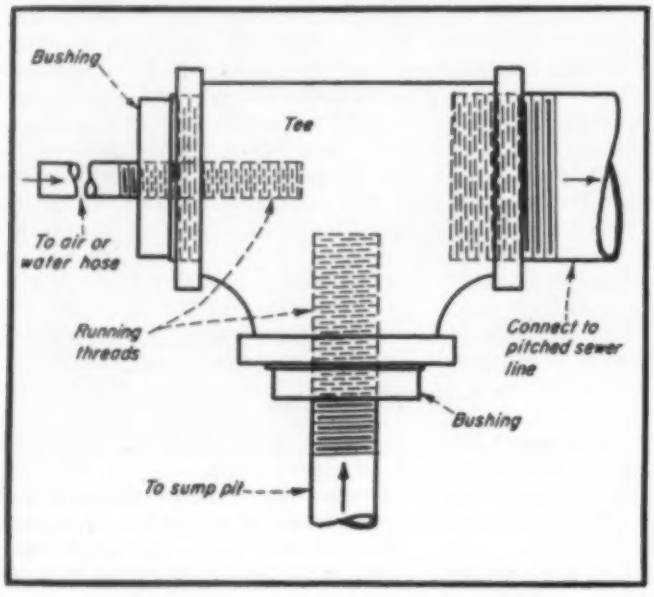
While the manufacture of electrical apparatus and equipment ranks below some other industries in volume, it does offer a fruitful field for the enterprising chemical engineer. The trend in chemical engineering in the past ten years has been encouraging, and is the result of a number of factors. The industry always has been interested in the improvement of its processes but the war and subsequent postwar competition have given added impetus. Quality and quantity at reduced prices has been and will continue to be the aim. As the supply of equipment becomes equal to the demand (this has already happened in many lines), efficiency and increased output per man hour are essential for continued healthy existence. This can best be accomplished by added emphasis on efficient process engineering. The familiar unit operation—cooling, drying, filtering, heating, evaporating, mixing, blending, separating, etc.—with which the chemical engineer is thoroughly versed is the logical approach. Improved process efficiency means increased production at lower cost without increased facilities. With equipment costs mounting this is a desirable end.

The chemical engineer in addition to improving existing processes can contribute much in such less thoroughly explored fields as solvent and byproduct recovery, water pollution abatement, manufacture of specialty chemical products.

Growth of chemical engineering in the electrical manufacturing industries has been a gradual and healthy one. Changes cannot be expected overnight, but the future assures a prominent place for the chemical engineer in the electrical manufacturing industry.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR



How to Make an Eductor Type Sump Pump From Fittings for Emergency Use

STANLEY YOKELL
Chemical Engineer, Union, N.J.

October Contest Prize Winner

WHEN a sewer line plugs up, a sump pump can be used to keep things dry while necessary repairs are being effected. A temporary, pitched pipeline can readily be strung, bypassing the plugged sewer section. Worn out or old sections of fire hose are excellent for this purpose. The high end of the line is connected to a sump pump, with the suction line to the pump inserted into the drain well, upstream of the plugged point.

A convenient, cheap method of accomplishing this end is to make an eductor, using standard pipe and fittings, readily available in most process plants. The fittings required are a tee, two reducing bushings and some short sections of pipe. The tee is bushed down on the run, and on the outlet. Two lengths of pipe are threaded 6 to 8 in., and one threaded end is screwed into the reducing bushing on the run, the other on the outlet. By adjusting the depth of pipe in the tee on the run end, a fairly good suction can be obtained at the outlet leg. This leg should also be adjusted to give best results. Care must be taken that no back pressure is built up, since the eductor will not function very well under back pressure.

This type of pump has been used successfully for the purpose described with air and water as the driving force. Since no electrical connections are required it can be used in almost any atmosphere without hazard.

November Prize Winner

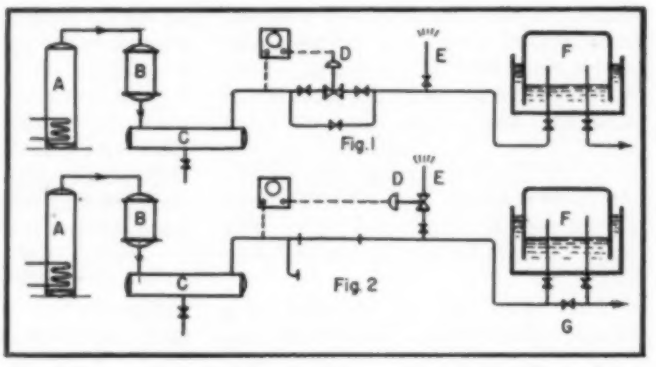
A $50 prize will be issued to

John P. Snyder

Chemical Engineer, Indianapolis, Ind.

For an article presenting a new and radically simplified nomograph for obtaining log means, such as means of temperature difference as used in heat exchange calculations. It can be used also in special slide rules.

This article will appear in our January issue. Watch for it and the other handy ideas in the Plant Notebook!



Deficient Pipeline Capacity Overcome By Rearrangement of Controller

A. K. RENSHAW
Engineer, London, England

FUEL GAS derived from the overhead vapor from a still was being used in an adjacent operation, but while the possible supply from the still was adequate, capacity of the pipeline at the available pressure was not enough. This article describes how the capacity was increased by a simple rearrangement of the still controls, without major pipeline alterations.

Fig. 1 shows the lay-out before alteration: the gas was released from a liquid boiling in tower *A*, cooled by water in aftercooler *B*, all condensible products being removed in knock-out drum *C*. The whole of this system was operated at a pressure of 1½-2 psig., controlled by recording pressure controller *D*. The gas was stored in gasholder *F* at a pressure of 6 in. w.g. before being transmitted to the consumer process through 300-400 yards of 6-in. dia. pipeline.

Both manufacturing and consuming plants had ample capacity, so that the limitation on output was the carrying capacity of the interconnecting pipeline, which was controlled by the pressure thrown by the gasholder. It would have been possible to install a booster at the holder outlet to force the necessary quantity of gas through the main, but

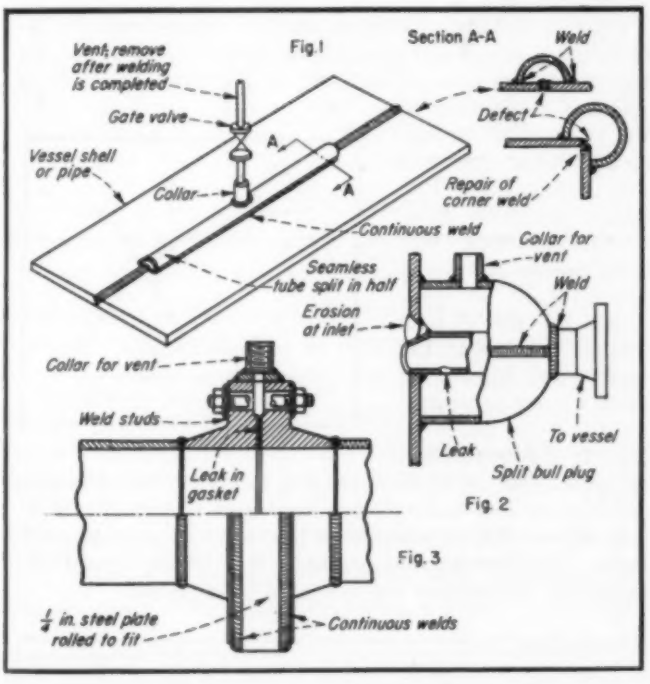
this seemed absurd when the gas was already being generated at a sufficiently high pressure. The problem was studied to find means to utilize this pressure, leading to the rearrangement shown in Fig. 2.

A bypass valve *G* was fitted to the gasholder and the pressure controller *D* was moved on to the pre-existing vent *E*, a piece of plain pipe being inserted in the main in its previous position.

In operation the valve *G* was kept open, while the gasholder itself was valved off, being kept full for emergency storage. The plant was set to make slightly more gas than was required by the consumer process, and the pressure was controlled by allowing the excess gas to be vented by the valve *D* in its new position, and vent *E*. This of course led to some waste which, however, could be kept to a minimum by observing the valve position indicator or, more accurately and more readily, by keeping the air pressure on the valve motor approximately the same as the air-line pressure, since the valve was of the "air-to-close" type.

The installation was completed by fitting a water seal at the consumer plant to protect it against excessive pressure if for any reason the whole pipeline system built up to full pressure. This could happen, for example, if the consumer plant suddenly stopped taking gas, for the installation presupposed that there would be a very considerable pressure drop along the interconnecting main.

The arrangement worked well. Closer coordination between the two plants was necessary, of course, since the cushion stock afforded by the gasholder was no longer available, but this proved to be no disadvantage.



Repairing Leaks in a Fluid Cat Cracker By Arc Welding During Operation

ROBERT H. DARLING
Assistant Area Engineer
The Texas Co., Port Arthur, Tex.

USE of welding in repairing leaks in operating petroleum refining equipment is a hazardous task at best, and on many types of units is never attempted. Progress to this end has been made, however, and within the past year we have attained a certain degree of perfection in the repair of several sorts of leaks on fluid catalytic cracking units while they are in operation. This has come about through suggestions by welders, pipefitters, operators and engineers alike.

Although the techniques discussed here are of the simplest types, it can readily be seen that the job can be an arduous one, taxing the facilities of the most skillful welder. Such repairs are made in the face of hot, leaking catalyst, sometimes at temperatures up to 1,000 deg. F., and often in the presence of lethal quantities of carbon monoxide. The real secret of the success that has been achieved lies in the venting or diversion of the hot catalyst and the gases away from the welder. This is accomplished by several means, whichever is applicable, including (1) pulling a vacuum on the vent; (2) smothering the leak with compressed air or steam; or (3) simply venting the leak to the atmosphere.

Frequently in the past year we have been confronted with the failure of seam welds in vessel walls and large pipelines, the latter ranging from 2 to 7 ft. in diameter. When catalyst begins to leak through these welds on account of its erosive character, it is but a short time until the size of the leak increases many times. Immediate action is required, therefore, to prevent such leaks from making so much headway they will become impossible to repair.

Patching a Seam Weld

A simple but effective way of patching such leaks is shown in Fig. 1. A piece of seamless steel tubing of diameter and length to fit the occasion is split in half and a steel collar and vent, containing a forged steel valve, are installed as shown. This assembly is placed astride the cracked weld and welded to the vessel or line. This method disturbs the old weld to the absolute minimum extent, since all the new welding, except for the plugs at the two ends, is between the tubing cover and the parent metal of the vessel or line. The method has been applied to welds on flat and cylindrical surfaces alike, as well as on the corner of square or rectangular chambers. The last is indicated in one of the detail sketches of Fig. 1.

A second type of leak we often meet occurs in the junction between a small connection and a large vessel or line. The catalyst tends to erode the metal away at the point of entry, as in Fig. 2, eventually causing a serious leak that is difficult to handle. Or, corrosion or erosion may cause a leak in the small connection itself. To repair leaks of this sort a bull plug is split in half as shown and used to case the whole. Again a steel collar is welded to the bull plug before it is placed over the leak, so that hot catalyst can be vented away from the welders.

Fixing a Gasket Leak

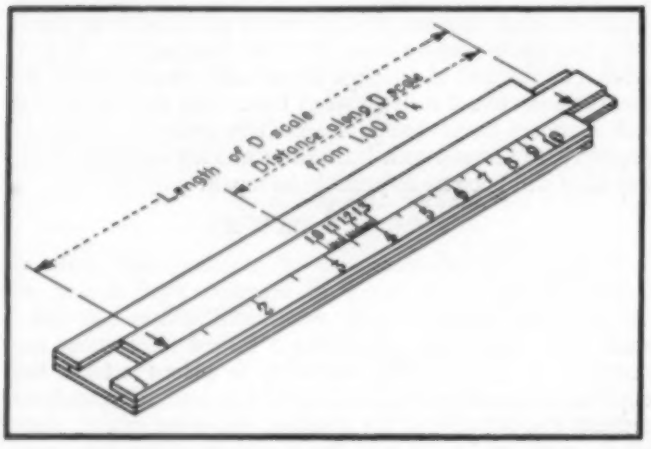
A third type of leak that occurs frequently is a blown gasket, either in a flanged pipe connection, next to a valve, or sometimes in the valve bonnet. To repair this type of leak (Fig. 3) we roll a piece of ¼-in. steel plate of suitable width to the diameter of the flange, install a vent collar as before, and weld it on with the vent opposite the leak. Here both the piece of plate and all the flange bolts or studs are welded to the flanges. This method has been applied to high pressure steam leaks, as well as catalyst leaks.

The examples cited are general in their scope, each leak as it occurs requiring individual treatment. Hence no set routine can be laid down. Further, the examples discussed are of the simplest types, affording a minimum of difficulties. Often adjoining pipework, structural steel, lugs, etc.,

Based on a paper submitted by the author to the James F. Lincoln Arc Welding Foundation in its recent $200,000 Design-for-Progress Award Program which called for papers on advances and improvements effected through arc welding.

are in the way and make difficult a job which would otherwise be simple.

The importance of repairs of this type can not be overemphasized from an economic standpoint. Heretofore, whenever a major leak occurred in a cat cracking unit, there was nothing to do but shut the unit down. This not only caused a minimum loss of five or six days production, and the loss of productivity of a large force of skilled operators, but also tended to disrupt the whole plant production schedule. Shutting down one of these units literally means the loss of thousands of dollars a day. The development of techniques such as those described here undoubtedly contributed very materially toward increasing the length of our last run on these units by nearly 50 percent over previous runs, that is, from 8 to nearly 12 months.



Slide Rule Modification Simplifies Routine Analysis Calculations

W. N. SMITH
Chemical Engineering Dept., Texas Div.
Dow Chemical Co., Freeport, Tex.

One of the most common control methods is that of routine analysis. Quite often this is done by nontechnical operators who have considerable difficulty in calculating the results by the familiar equation:

$$\frac{\text{Titration} \times \text{Normality} \times \text{Milliequivalent Weight} \times 100}{\text{Sample Volume} \times \text{Specific Gravity}} = \%$$

In routine work the normality, milliequivalent weight, and sample volume are usually constant and the equation can be simplified to

$$\frac{\text{Titration} \times k}{\text{Specific Gravity}} = \%$$

where k = (Normality × Milliequivalent Weight × 100) ÷ Sample Volume = Constant.

We can, of course, teach the operator to use a regular slide rule or make a nomograph for the equation. However, it is much easier to make a simplified scale to glue on a regular slide rule than to lay off the logarithmic scales required by the nomograph. Also, a slide rule is more convenient to handle.

The simplified scale can be made as follows:

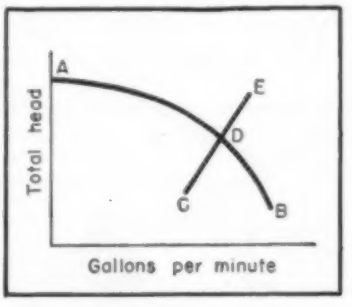
1. Lay off a straight line the length of the D scale of the slide rule to be used. Draw arrows at both ends of the scale.
2. Determine k as defined by the second equation.
3. From the right hand arrow lay off a distance corresponding to the logarithm k. (This length is taken directly from the D scale of the slide rule.) Label this point 1.00.
4. Starting at 1.00, lay off to the right a log scale the same as the D scale and continue up to the value of the maximum specific gravity expected. This is the specific gravity scale.
5. Glue the scale so made on the moveable bar of the slide rule, covering the existing scales.

To use the slide rule set the specific gravity opposite the titration. The arrow will point to the answer.

Estimating Centrifugal Pump Delivery Through a Pipeline

JAMES J. FLYNN
Chemical Engineer, Continental Distilling Co.
Philadelphia, Pa.

It is frequently desirable, in making process changes, to install a centrifugal pump from stock in a pipeline. To determine the expected delivery at the pipe terminus, a trial and error calculation is involved in balancing the pressure drop through the line against the rated delivery of the pump. The work can be simplified somewhat by superimposing on the characteristic curve of the pump (line AB on the plot) a curve representing the total head vs. the rate of flow through the pipe (line CE). This curve is obtained by calculating the friction loss and velocity head and adding the static head for a sufficient number of flow rates to give a smooth curve. The intersection of these two curves (point D) represents the delivery conditions to be expected.



$50 Cash Prize For a Good Idea!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e. g., the December winner will be announced in January and his article published in February. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers or others in the process industries.

Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

ABRACADABRA!

(or begone, hydrogen sulphide)

Would be nice if the growing problem of liquid hydrocarbon purification could be settled by magic spell. The next best thing is a Girdler GIRBOTOL plant. The GIRBOTOL process, noted for effective, economical hydrogen sulphide removal in the gaseous phase, has been adapted with equal effectiveness and economy to hydrogen sulphide removal from butane, propane, polyfeed stocks, straight run naphthas, and gasoline. Twenty plants are now operating or under construction. If you have a liquid stream containing 500 pounds or more of hydrogen sulphide per day, a Girdler GIRBOTOL plant will save money. Investigate.

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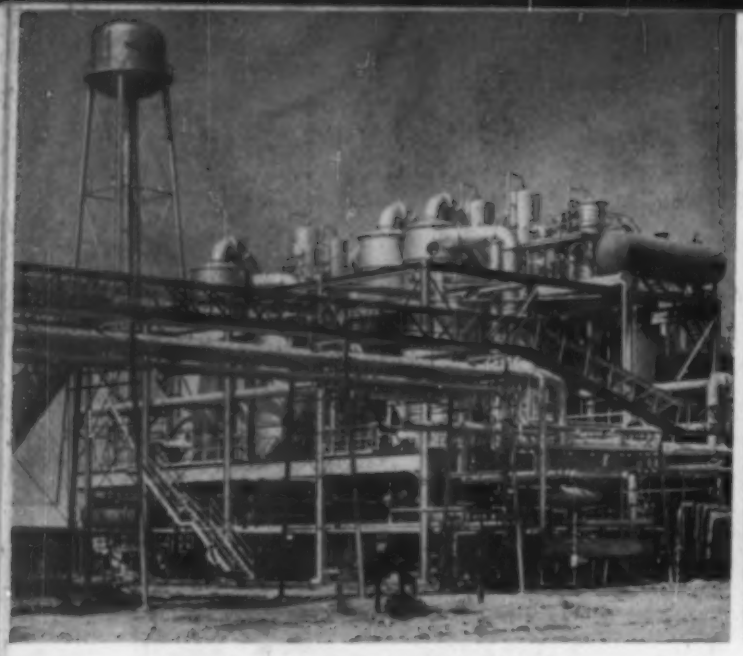
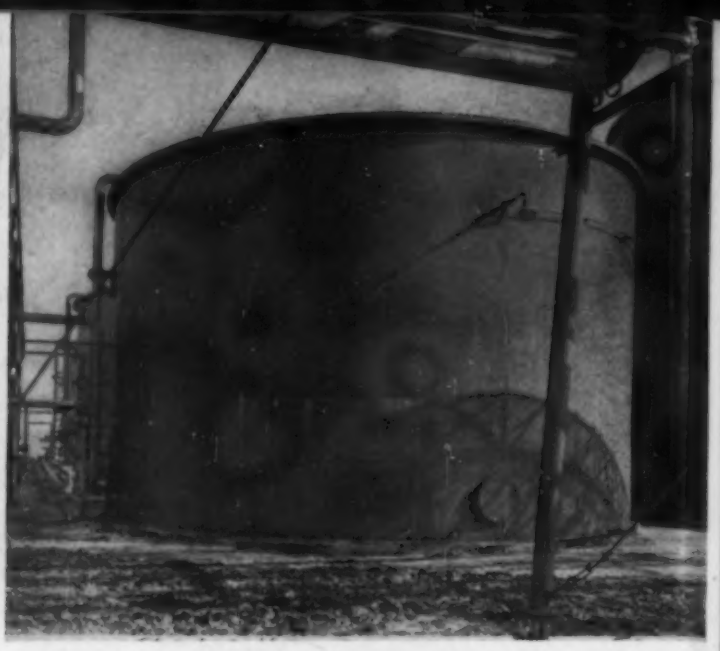


Evaporators at Diamond Alkali's new plant near Houston which turns out chlorine, caustic and hydrochloric acid.



1 Recycling brine from these treat liquor storage tanks to the carbonating tower achieves the desired degree of carbonation.

Chlorine-Caustic Soda

SEE ARTICLE ON PAGE 112

ITS BIG new caustic-chlorine plant near Houston is Diamond Alkali's opening gambit in its expansion into southwestern chemical enterprise. With a rated capacity of 220 tons of chlorine every 24 hr., the plant is now turning out chlorine, 50 and 73 percent caustic solutions and hydrochloric acid. Soon solid, ground and flaked caustic will be coming from the plant. And in the future, Diamond hopes to produce chlorinated organics.

Diamond's new plant has many advantages and innovations. Abundant natural gas provides cheap power and steam. Dissolving of salt in the big underground deposits owned by the company and pumping of the brine through a pipeline has eliminated rail shipment of the salt. From brine treatment to caustic evaporation, process equipment is duplicated, minimizing shutdown risk. The electrolytic cells are of improved design. Chlorine liquefaction has been made more economical. A better method of producing solid, ground and flaked caustic has been devised.

Brine is pumped 17 mi. to the plant. Calcium and magnesium salts are removed from the brine by a mixture of sodium carbonate and sodium hydroxide. The purified and filtered brine goes from storage to a preheater where it is raised to 160-190 deg. F. Next it goes into saturation tanks and then into a superheater that raises its temperature to 210 deg. F. This prevents settling of salt in the cell lines. After neutralization with hydrochloric acid, the brine goes to the distributing system in the cell room.

Chlorine saturated with water vapor leaves the cell room at about 180 deg. F. It is cooled to 60 deg. F. and dried first in ceramic and then in cast iron towers, using sulphuric acid. Dry chlorine is compressed to about 45 psi. and scrubbed free of sulphuric acid and organic matter. Next the chlorine enters the unusual liquefaction system. There it is chilled and liquefied by direct heat transfer from chlorine to Freon. Liquid chlorine flows to weigh tanks and is transferred to cylinders, tank cars or the pipeline to the Shell Chemical Corp. plant.

A compact unit with a rated capacity of 10 tons of 33 percent acid every 24 hr. turns out hydrochloric. A gas containing a low concentration of chlorine is charged to the unit. This gas comes from the recompression system after chlorine liquefaction. Gas from the compressor moves to a furnace and is combined with hydrogen from the cell room. The mixture passes through a silica tube inserted in one end of a horizontal, cylindrical, refractory-lined chamber. Combustion products leaving the tube pass through the chamber and enter a Karbate cooler. The cooled gases then enter an absorber which utilizes water as the absorbing agent. There most of the hydrogen chloride is absorbed and, after concentration has been built up, the hydrochloric acid is pumped to storage.

Caustic recovered from cell liquor averages from 96 to 98.5 percent by weight. The liquor leaves the cells with a concentration of about 11 percent NaOH and 15 percent NaCl. A first evaporation in double-effect evaporators concentrates the liquor to 35 percent caustic, and a second evaporation in single-effect evaporators raises it to 50 percent. Both sets of evaporators have salt settlers. Salt from settlers is fed to continuous rotary vacuum filters. Fifty percent caustic is cooled to 100 deg. F. and bleached. Next it is cooled to about 60 deg. F., using refrigerated water. Then it is pumped to Vallez filters. From the filters, caustic containing about 1 percent NaCl is pumped to storage from which it is loaded into cars or piped over to the Shell plant. Some caustic from the Vallez filters is further concentrated to 73 percent strength.

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December 1948
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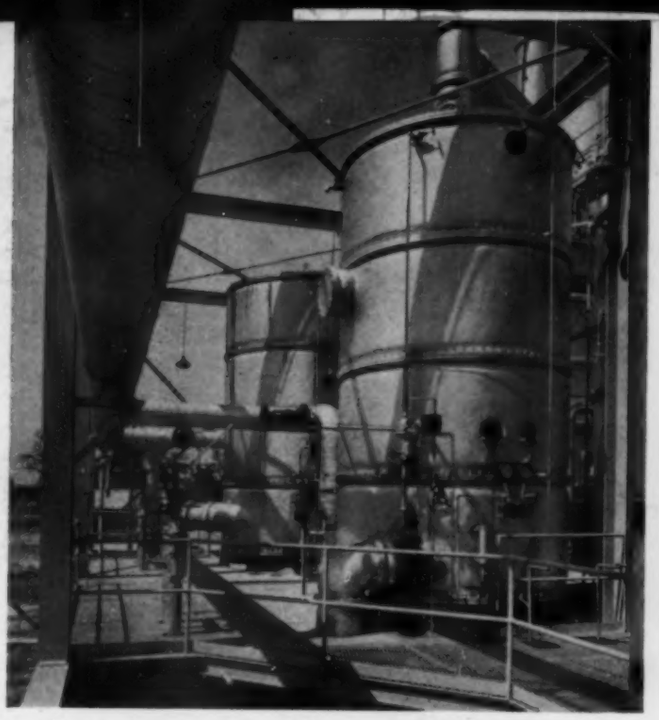
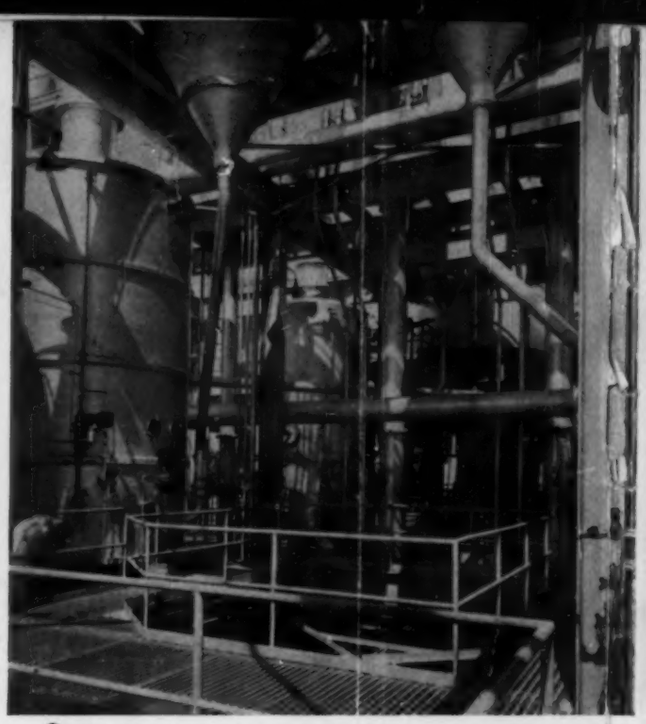
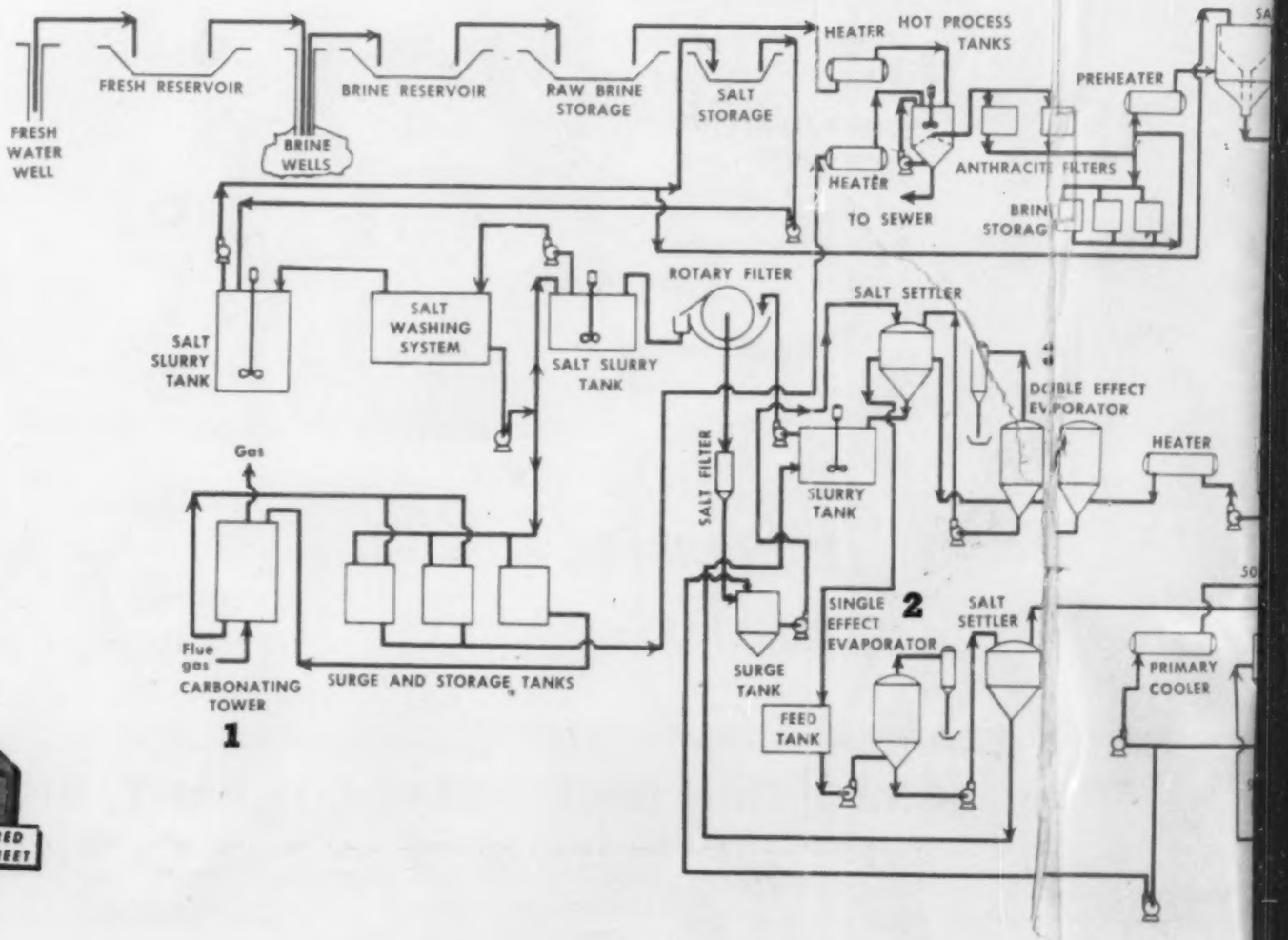


2 Caustic is concentrated in two stages, first to 35 and then to 50 percent. Two first-effect evaporators and steam line.

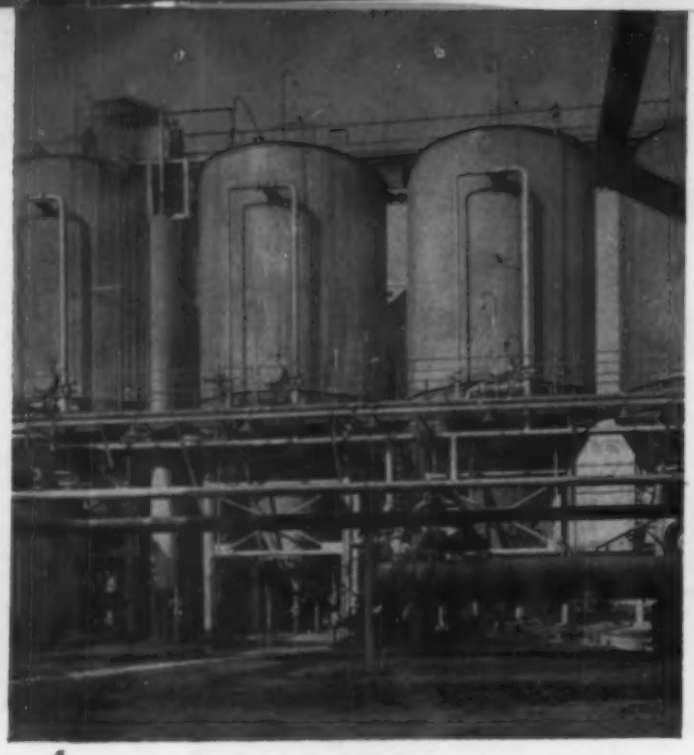


3 Second-effect evaporator, single-effect evaporator and salt settling tank, left to right. Above, bottoms of separators.

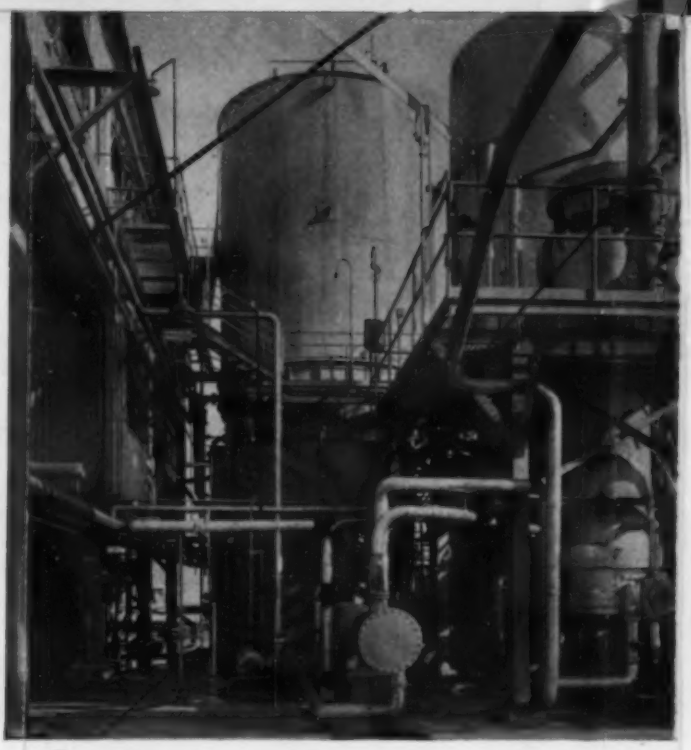
4 Circulating
percent causti



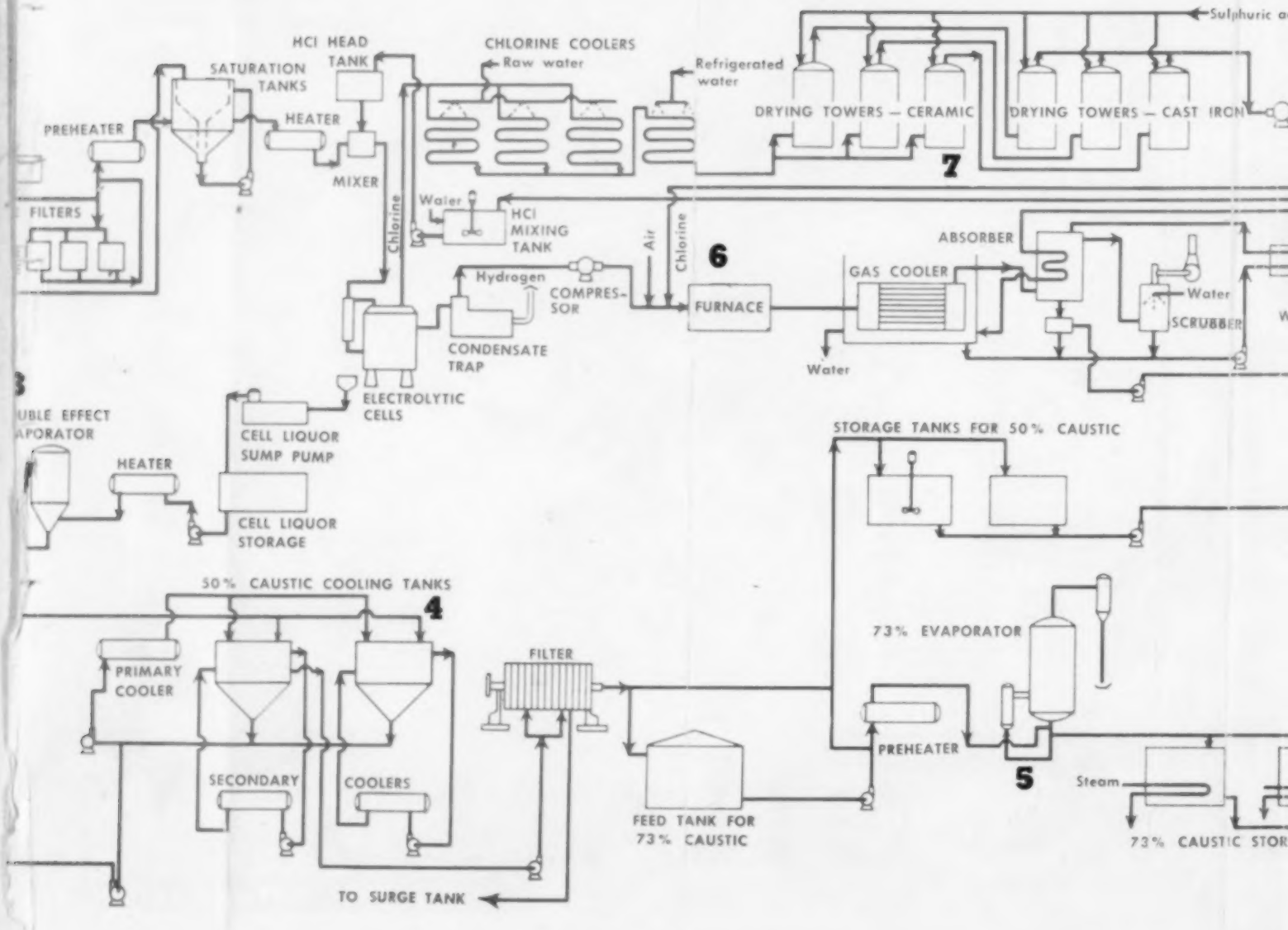
Chemical PICTURED FLOWSHEET

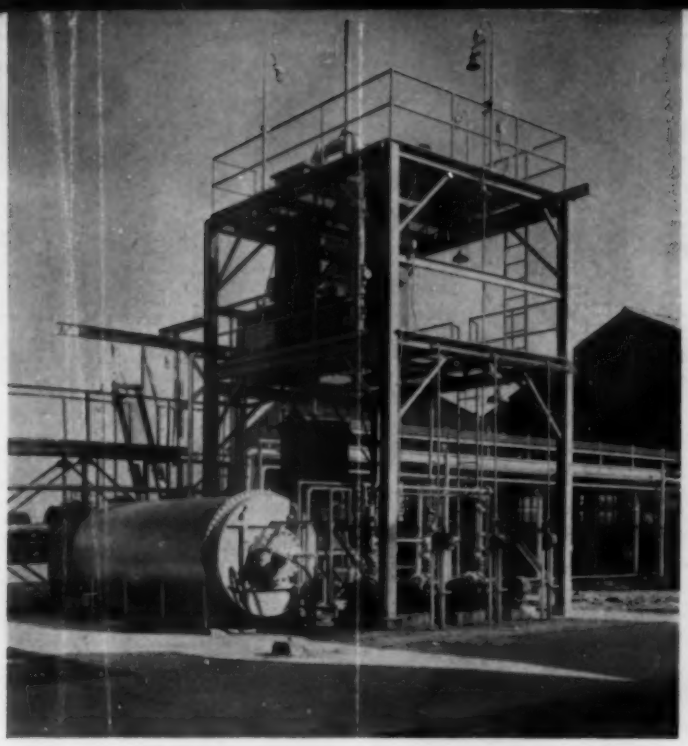


4 Circulating through primary and secondary coolers, the 50 percent caustic in these cooling tanks drops finally to 60 deg. F.

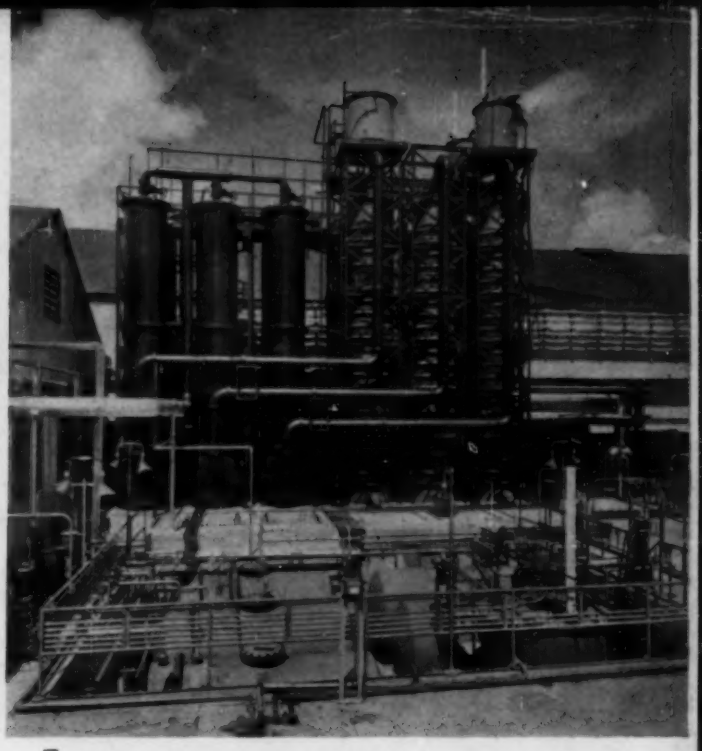


5 Caustic strength is raised from 50 to 73 percent in this high concentrator after solution has been pumped through preheater

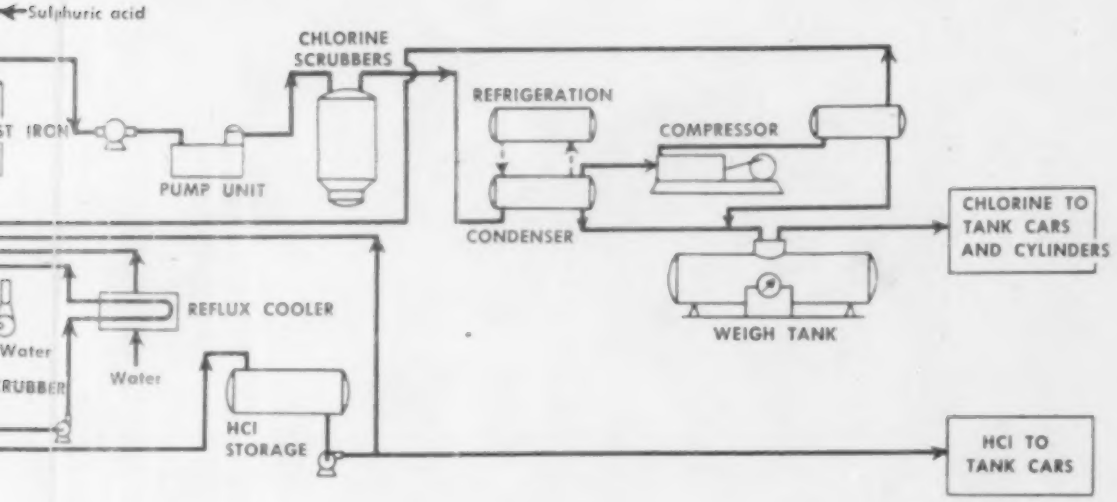


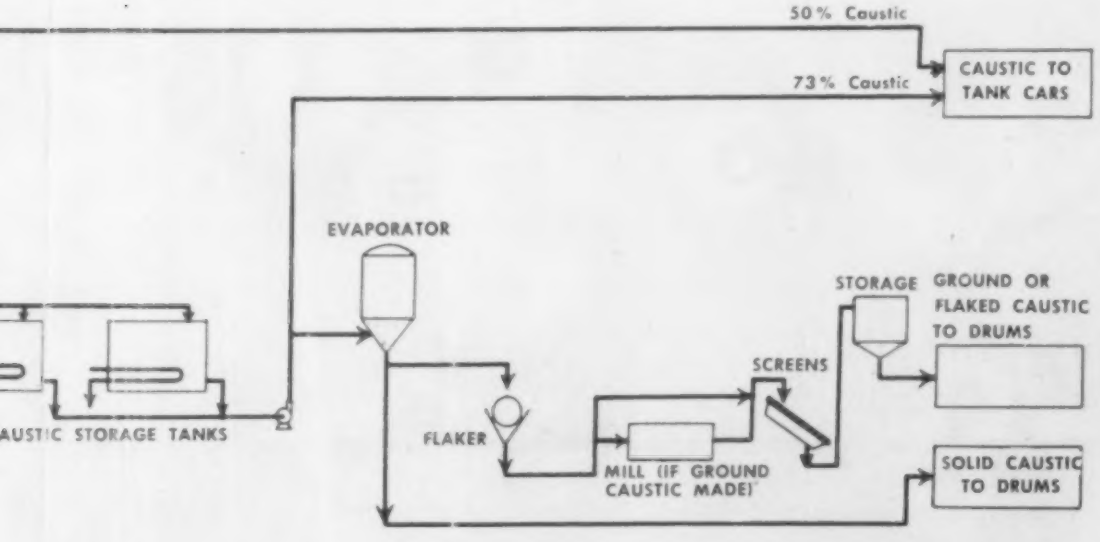


6 Hydrochloric acid unit can turn out 10 tons a day. Hydrogen and chlorine combine in the refractory-lined cylinder at left.



7 Cooled chlorine passes through three ceramic and three cast iron drying towers contacting sulphuric.





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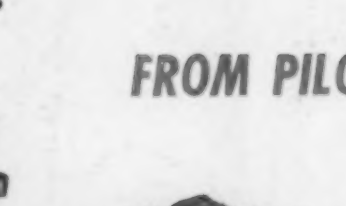

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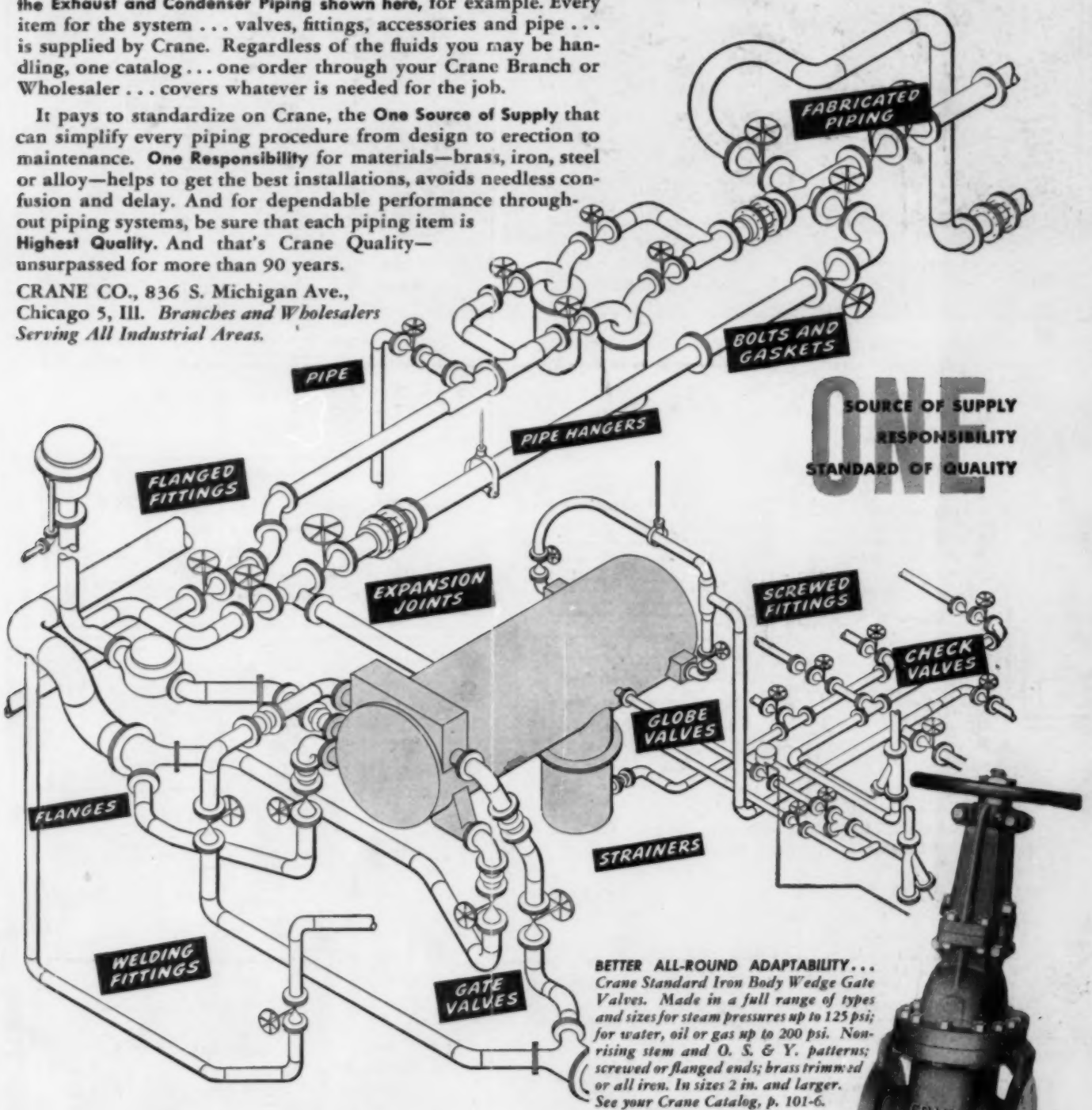

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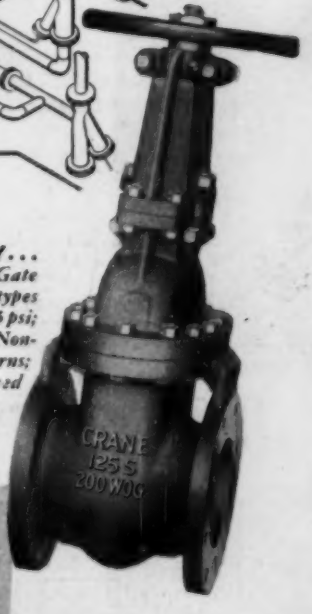

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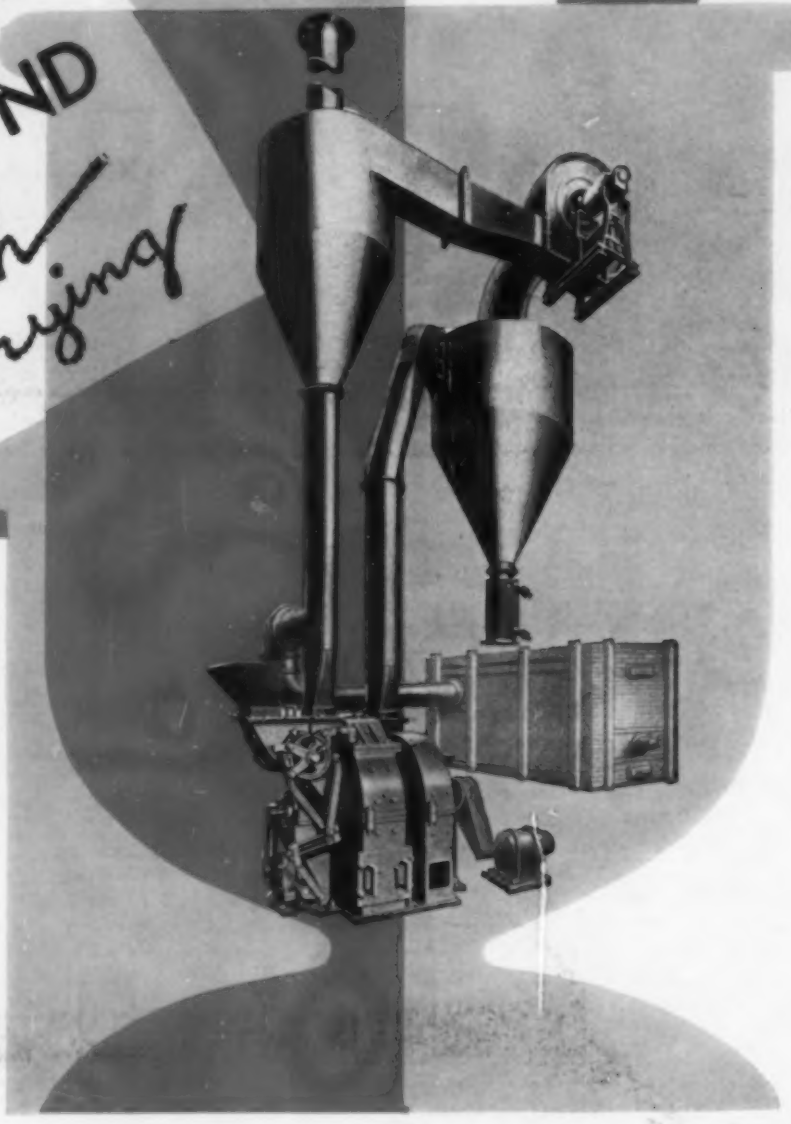

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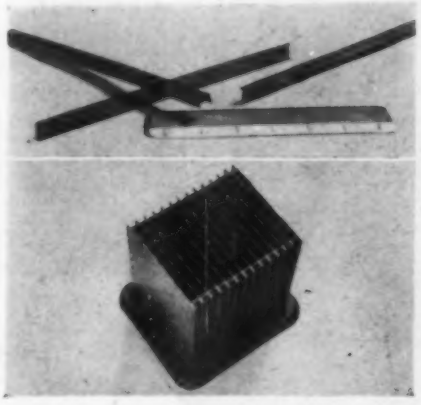
PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR



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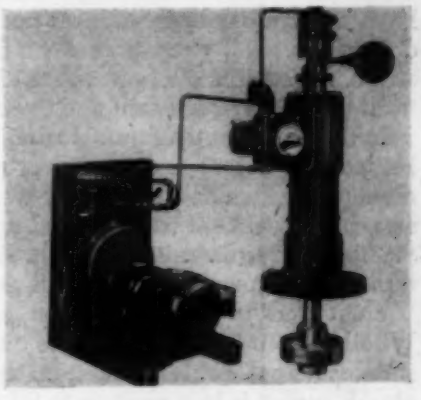
1. Oxygen Plant

FOLLOWING the announcement of the new tonnage oxygen plant developed and offered by the Elliott Co., Jeannette, Pa., which appeared on page 153 of our May 1948 issue, the company has issued further details and a flowsheet showing all major equipment in the autumn issue of its quarterly magazine, *Powerfax*. Our earlier article pointed out that the system operates at close to atmospheric pressure, requires no periodic shutdowns for deriming, produces oxygen of 95 percent purity (but can also make about 5 percent of its output as 99.5 percent), and produces 99.5 percent nitrogen. It is completely automatic, is said to be free from any possibility of acetylene explosions, and uses an expander type cycle requiring no auxiliary refrigeration, except for washer water cooling.

Air purification is accomplished by washing and chemical adsorption, followed by the use of clean-up exchangers of novel type. The two accompanying views indicate the construction, designed for mass production techniques, which involves use of simple fins of thin copper which are bonded together between brass plates. Alternate channels are manifolded together to permit counterflow. Flow is switched for purging only every four hours, in contrast to the switching every few minutes in most systems. The construction provides over 300 sq. ft. of effective surface per cubic foot of exchanger, and over 3.5 sq. ft. per pound of metal. Only about 10 percent of the nitrogen is required for purging, and this part alone is wasted.

Use of much lower temperatures in the Elliott system as compared with the Linde-Fränkl, means much lower residual CO_2 and hence no need for deriming. Other economies come from the use of lower pressures. All compression is by centrifugal equipment and the expander also is of the centrifugal type. The nitrogen part of the cycle is novel, supplying the refrigeration for the system by compressing a part of the leaving nitrogen to 93 psia. in a two-stage centrifugal compressor which is the principal power user of the system. Part of the compressed nitrogen, after precooling, is further cooled in the expander which is loaded by a part of the initial air compression. The nitrogen cycle operates in such a way that the quantity of nitrogen reflux available for the main column is independent of the quantity of air charged which gives the system its high oxygen recovery and wide degree of flexibility.

The main 95 percent oxygen product is produced in a main distilling column. However, a small stripper column is also provided to take some 5 percent of the main product and reduce the nitrogen to 0.5 percent. However, the relative proportions of the two products are quite flexible, within the design limits of the system.



2. Hydraulic Drive

USING PUMPS of its well-known Rotocycle design as the hydraulically coupled activating mediums, the Hydraulic Division of Rockwell Mfg. Co., Pittsburgh 22, Pa., is now engaged in the engineering of a variety of hydraulic drives, for example, agitator

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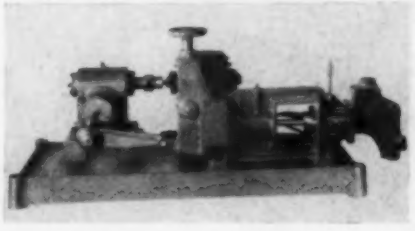
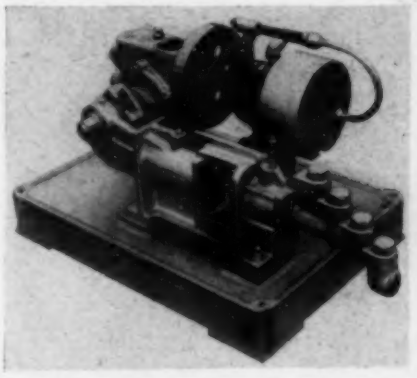
drives on pressure vessels. The hydraulic motor may be located remotely from the hydraulic pump, and the hydraulic circuit can be arranged so that several motors are supplied with fluid pressure from one central pumping source. In the company's Hydro-Sin governing system, used to maintain a constant predetermined speed, the desired speed is first set by adjusting the position of a main circuit control valve on a graduated dial. This speed is then maintained through the functioning of a separate hydraulic control circuit which operates on the constant pressure differential principle through a pilot valve. Should this constant pressure differential be upset for any reason, the pilot valve instantly reacts to reposition the proportioning of fluid to the main hydraulic motor. This system can be used to maintain any predetermined condition of speed, torque, pressure, volume or liquid level. Such drives are furnished in speed ranges up to 5,000 rpm., and in ratings from fractional to 125 hp., or greater.



3. Proportioning Pumps

A NEW LINE of high-pressure, variable-capacity chemical proportioning pumps has been put on the market by the Orchem Pump Division of Orlich Bros. Machine Works, Philadelphia 37, Pa. The new pumps offer double ball checks on both suction and discharge, with access to the valve interior without removal of the suction and discharge piping. They are said to be non-air-binding and to assure maximum displacement efficiency and minimum slippage. The new design of valve has only two caps to remove to gain access to all four ball checks. Long packing glands are provided, with screwed gland caps. The length of stroke is adjustable on all pumps from zero to 100 percent rated capacity. Standard pumps are provided with a manual adjustment to the length of pump stroke which can be made while the pump is stopped. The Autajust pump permits capacity variation to be made while the pump is in operation, by means of a handwheel which has no motion. This is the wheel evident above the motor in the accompanying view. These pumps can be provided with electronic stroke adjustment to enable process control to be made from one or more variables. They are produced in sizes from 1 pint to 3,000 gph. for pressures up to 25,000 psi. They can be made in any metal, alloy, or plastic that can be cast, machined, or ground.



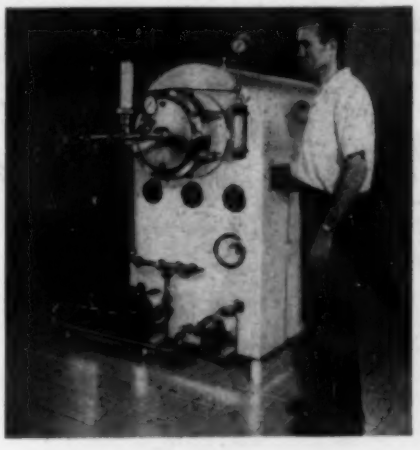
4. Air-Driven Pump

FOR USE where electric power is not available, or where explosive atmospheres make it desirable to use compressed air or gas as the power source, Milton Roy Co., 1322 East Mermaid Rd., Philadelphia 18, Pa., has introduced an air-powered proportioning pump known as the Airometric. This pump is produced in simplex and duplex models and is driven by a 1-hp. rotary air motor capable of being operated on compressed air or natural gas at pressures from 50 to 80 psi. A pressure regulator and indicating gage are supplied with each unit. The maximum motor speed of 1,750 rpm. is held constant by a governor which throttles the air exhaust from the motor. A speed reducer transmits power from the motor to the pump. Pumping capacities range from 1.2 to 75.5 gph. for the simplex model, and twice that for the duplex. Maximum discharge pressures range from 115 to 9,500 psi., varying with the volume of liquid pumped. The pump end is of this company's standard step-valve construction.

5. Gamma Ray Gage

TO PERMIT liquid level measurements inside process vessels without having connections of any kind from the outside to the inside of the vessel, Engineering Laboratories, Inc., Tulsa 3, Okla., has introduced the Gagetron, a device employing gamma rays to show the position of a float within the vessel. The gamma ray source is an iridium-platinum needle containing a minute quantity of a commercially available radium salt. This is placed inside a corrosion resistant float, which remains on the surface of the liquid directly below a gamma ray detector. Since the gamma ray absorption factor of the vessel wall below the detector is a constant, the amount of detected gamma radiation is inversely proportional to the square of the distance between the gamma ray source and the detector. A feedback circuit incorporated in the electronic detector converts the square relation to a linear relationship, so that the current flow is readily converted into height of the liquid level.

The instrument operates on standard a.c. power and can be combined with a recording controller to maintain a predetermined liquid level and give a continuous graphic record. An alternate method that has also been used is to secure the radium source inside the tank at the control level, with the detector at the same horizontal level outside the tank. Then, as the level rises or falls below the control point, the amount of gamma radiation received by the detector will vary, depending on its absorption by the liquid in the tank.



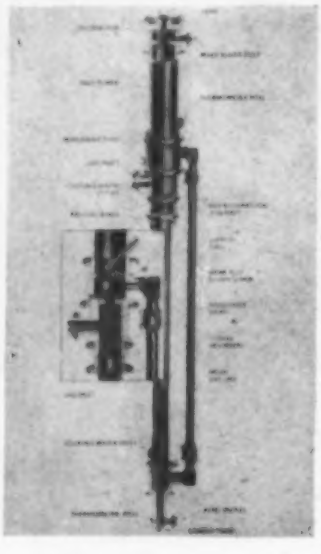
6. Continuous Mixer

MANUFACTURING and leasing rights to the Oakes continuous automatic mixer, developed by the E. T. Oakes Corp., Douglaston, L. I., N. Y., have been acquired by the American Machine & Foundry Co., 485 Fifth Ave., New York 17, N. Y. The machine was developed initially for continuous mixing applications in the manufacture of food products, but is now being used successfully in the production of foam latex and is being tested on a variety of other materials in the chemical field. Depending on the product mixed, its capacity ranges upwards to 6,000 lb. per hr., and yet it occupies but 8 sq. ft. of floor space. The mixer can be used

to incorporate air or gas bubbles into the blend, or it can be used for the emulsification of liquid phases.

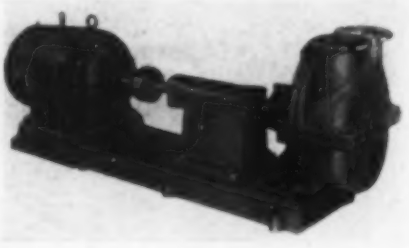
In the accompanying illustration, the casing contains the variable speed motor drive for the mixing head, as well as the variable speed feed pump drives. The mixing head is the cylindrical portion shown extending from the front of the casing. This head consists of a cylindrical housing or stator of relatively small height in comparison with its diameter. Rotating within this housing is a rotor. Numerous projections on the two faces of the rotor pass close to similar projections on both inner faces of the stator. Feed enters at the center of the back of the rotor, flows radially outward between rotor and stator, then flows radially inward over the near side of the rotor, leaving at the center.

This construction permits a tremendous number of shearing actions to be concentrated on the small quantity of material within the mixing head at any instant. In the case of foam production, this assures a small, uniform cell structure. Similarly, in the production of either homogeneous mixtures of liquid phases, or emulsions, it is claimed that maximum dispersion of the components is secured for a minimum expenditure of power.



7. HCl Absorber

TAKING ADVANTAGE of the high thermal conductivity of Karbate impervious graphite, the National Carbon Co., 60 East 42nd St., New York, N. Y., has introduced its Model 6B falling film type hydrochloric acid absorber. The new unit is of the packaged type, with all accessories for automatic operation. The unit occupies a floor space of approximately 3x4½ ft. and is 21½ ft. high. It has an output of 2½ to 16 tons of acid per day and is stated to return its installed cost in the value of commercial acid produced in 14 to 37 days. In this unit the gas and liquid streams flow co-currently in the first stage and counter-currently in the second. Two or more units can be connected in parallel to handle gas rates exceeding those of a single absorber. Absorbers of this type are being used in recovery of HCl produced in the manufacture of DDT and Freon.



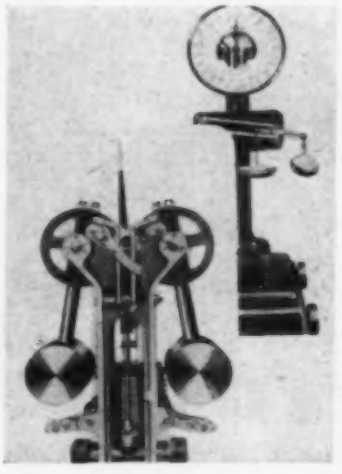
8. Stoneware Vacuum Pump

BELIEVED to be the first vacuum pump of its kind offered in this country, a rotary seal type chemical stoneware vacuum pump is being produced by the General Ceramics & Steatite Co., Keasbey, N. J. In addition to its use as a vacuum pump in the handling of corrosive gases, the pump can also be used in positive pressure service up to a pressure of 2 atm. It is produced in armored chemical stoneware and can use any type of sealing liquid or gas, of course, with the exception of hydrofluoric acid and caustic alkalis. It is particularly suited for the handling of wet chlorine and related products. Available at present in the 2½-in. size, the pump will shortly be made also in 1½- and 3-in. sizes, for belt or direct drive.

9. Corrosion Resisting Coating

RESISTANCE to most acids, alkalis, solvents and mixtures of such materials is claimed for Carbo-Kote, a product of the Carboline Co., 502 North Taylor St., St. Louis 8, Mo. The material has been developed primarily for coating wood, but is said to work equally well on rubber, carbon, and fiber glass, while a special primer is under development which is expected to permit its use on steel and other surfaces. The material is applied with a paint brush at ordinary temperatures, producing a coating impervious to penetration by moisture or corrosives which is 8 to 30 times the thickness of a coat of paint. It is claimed the coating cannot be separated from the wood, joints made with it being stronger than the wood itself. It sets by polymerization at room temperature, neither evaporation nor oxidation being involved in its application or use. It produces a hard, wear-resistant surface, and is attacked by few materials, chiefly nitric acid and sulphuric acid over 45 percent concentration.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160



10. Dial Scale Mechanism

IMPROVED sustained accuracy, ruggedness and long life are claimed for the new Magnetrol dial scale mechanism introduced by the Yale & Towne Mfg. Co., Philadelphia Division, 4530 Tacony St., Philadelphia 24, Pa. The new mechanism achieves a straightline relationship between the platform load and the pointer movement without specially filed cams. It also reduces service adjustments from the usual six or seven to only two. An important new feature is the use of a permanent magnet to secure light engagement between the pointer rack and the pinion at all times so as to minimize friction and yet keep the teeth in full engagement under just the desired pressure. Linearity of movement is achieved because the horizontal component of the displacement of the pendulum weight is directly proportional to both the draft band pull (over a circular drum) and to the vertical component of the displacement of a small roller carried by the drum. Since there are two opposed drum systems the vertical movement

Through constant research and development, the textile industry has done much to provide cheaper, more efficient products. Typical of this progress are the advancements made in the dyeing of textiles. Often, Victor* formic acid is used as an acidulent in the dye bath. This medium-strength acid produces colors that are both level and fast, and complete exhaustion of the dye assures economy. Because of the volatility of formic acid, danger of tendering the fabric is eliminated. In addition to formic acid, many other Victor chemicals serve as a helping hand in the textile industry.

A Helping Hand for the TEXTILE INDUSTRY

for 50 years VICTOR CHEMICALS *for everyday Living*

*TRADE MARK

VICTOR CHEMICAL WORKS

Victor chemicals used in the textile industry include:

Sodium Phosphates . . . buffer in dye baths, detergents, dyeing, process water treatment, water softeners.
Victawet 35 B, Victawet 12 . . . dye carriers, penetrants.
Flexible Fyrex, Ammonium Phosphates . . . flameproofing.
Victawet 58 B . . . dispersing agent.
Phosphoric Acid . . . dyeing.
Victamine D . . . textile softening agent.
Aluminum Formate . . . waterproofing.
Formic Acid . . . acidulent in dye bath.
Oxalic Acid . . . bleaching.
Sodium Formate . . . buffer in wool dye bath.
Diammonium Phosphate . . . metachrome dyeing of wool.

VICTOR CHEMICAL WORKS, 141 West Jackson Boulevard, Chicago 4, Illinois

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AMOSITE
ASBESTOS
FIBRES

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FOR FILTRATION,
PLASTIC REINFORCEMENT
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Amosite is an extremely long acid resistant asbestos fibre mined in South Africa. It is especially suitable for filtration and similar processes. Available in various grades and degrees of opening to meet specific requirements.

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Thermocouple
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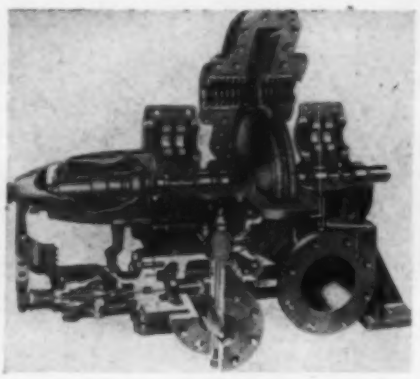
PANELS

Made in various combinations of jacks and plugs, provide a quick and flexible method for easily connecting groups of thermocouples to pyrometers. Ideal for Pilot Plant use. Positive Spring Jacks and Plugs made of standard thermocouple materials.

Write for complete information

Thermo ELECTRIC CO.
FAIR LAWN, N.J.

of the rollers, which is translated through a yoke plate to a vertical rack, is linear with respect to the platform movement.



11. Mechanical Drive Turbine

A NEW all-weather, general-purpose turbine for driving pumps, fans, compressors, paper machinery, and similar applications, is being offered under the name of Typee by the Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. The turbine is available with 16-, 20- or 25-in. wheels for power output in the range from 5 to 1,500 hp., with steam conditions up to 600 psig. at 750 deg. F., and speeds from 1,000 to 7,000 rpm. It is provided with an efficient combination felt and labyrinth bearing seal to protect the lubricating system from abrasive dusts or torrential rains. Corrosion resisting materials are used liberally for outdoor process plant service. The turbine is equipped with a shaft type governor mounted in a rugged casing that completely protects the governor assembly and shaft end. Special wide range speed governors may be secured when required.

12. Thermal Barrier

OBTAINABLE in various consistencies for application by trowel, brush, or extrusion gun, two new thermal barrier compounds for withstanding temperatures as high as 2,800 deg. F., have been added to the line of Stabond cements produced by American Latex Products Corp., 921 Venice Blvd., Los Angeles 15, Calif. In a typical test, an oil tank covered by a ½-in. coating of one of these materials withstood a 2,000-deg. flame blast for 36 min., without damage to the underlying metal. The same flame burned through a tank without protection in one-half minute. The materials are suitable for lagging hot surfaces wherever resistance to vibration as well as heat is needed, and can be employed where abrasion resistance is likewise required. These materials, initially plastic in nature, cure by solvent release at about 80 deg. F., forming a hard but not inflexible sheath which can be reinforced during formation with certain materials, such as perforated glass cloth. FR-8 resists temperatures to 2,000 deg., while FR-10 is similar, but suitable for temperatures to 2,800 deg. F. for 15 minutes, or higher temperatures intermittently.

13. Steam System Cleaner

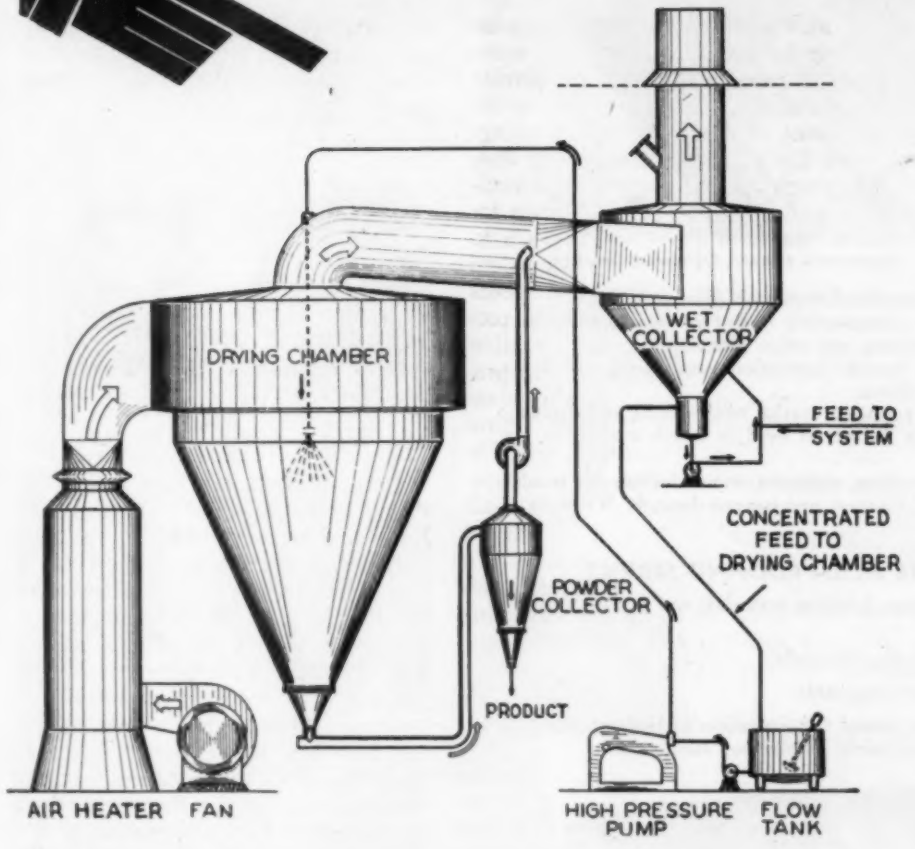
COMPLETELY automatic operation in the removal of scale and products of corrosion from steam systems is claimed for the Pressure-Jet unit offered by Pressure-Jet Systems, Inc., 333 West Reservoir Ave., Milwaukee 12, Wis. Employing a special fluid which is electrically heated in the unit and atomized at high temperature into the steam main beyond the boiler, the device is claimed to treat every part of the steam system, including supply and return lines and all steam operated equipment. It removes scale, oil sludge, rust and other materials which are dissolved into minute particles and held in suspension, flowing off with the condensate. The fluid is said to be non-injurious to ferrous or non-ferrous metals, packings or gaskets. It is said to control acidity, to clean existing equipment and keep it clean, and to protect new equipment and lengthen its life.

14. Pulverized Coal System

SAID to be the first installation of its kind in the cement industry, the largest capacity circulating system ever built for firing pulverized coal has been installed for standby fuel capacity for kilns of the Universal Atlas Cement Co., at Independence, Kan. The system, built by Babcock & Wilcox Co., New York, will be used to supplement natural gas fuel during the winter when the supply of natural gas is frequently inadequate. It employs a

SPRAY DRYING

for the Process Industries

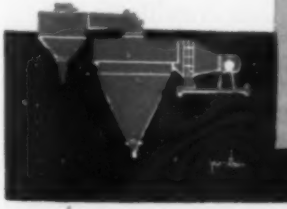


Typical application of a direct-fired Swenson Spray Dryer—in this case used for drying inorganic salts. Solution to packaging in one step.

Swenson takes undivided responsibility for the design, fabrication, erection, and initial operation of your spray-drying system.

Only Swenson can offer all these:

1. Modern full-scale plant facilities for experimental work.
2. Complete design and engineering of equipment to meet your exact process requirements.
3. Complete manufacturing facilities.
4. Complete erection service.
5. Initial operation under the supervision of experienced chemical engineers.



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DIVISION OF WHITING CORPORATION
15669 Lathrop Avenue Harvey, Illinois
Export Department: 30 Church Street, New York 7, N. Y.
In Canada: Whiting Corporation (Canada) Ltd., 45 Richmond St., West, Toronto

Here you see a concrete floor and three cotta channel pipe. Acid has eaten out the concrete and mechanical damage then destroyed the pipe.

Condition Caused by ACID... *Permanently Cured by* ATLAS!

...and here is the floor reconstructed with acid-proof brick, joined with ALKOR, Atlas acid- and alkali-proof cement. This Atlas floor is completely PROOF AGAINST, *not merely "resistant to" inorganic acids (except those of an oxidizing nature) and all alkalies in all concentrations.*

(*Construction by Kayel Engineering Company*)

These photographs, taken in a prominent New Jersey chemical plant, show how ordinary concrete capitulated to the attack of acids and oil ... and how the trouble was corrected by reconstruction with Atlas materials.

Atlas materials, plus Atlas design, have permanently ended corrosion difficulties in hundreds of chemical, steel, food processing, and other plants.

Atlas construction is planned to meet specific corrosion conditions, and Atlas materials can solve *your* acid-proofing problem.

Atlas construction is used in floors, tanks, towers, stacks, neutralizing and disposal units. Atlas has experience covering every industrial field in which corrosives are used or encountered.

Atlas engineers will gladly study your problem, make recommendations and render plans and estimates — without obligation. Contact our nearest branch. Write us at Mertztown for Technical Bulletin T11-C.

ATLAS RENDERS A COMPLETE ACID-PROOFING SERVICE

Materials: **cements, rubber or plastic linings, jointing materials and protective coatings and paints.**

Design: **to meet specific conditions and indicated needs.**

Installation: **supervised, if desired, by our engineers.**

This complete service from a single source means concentration of responsibility ... and insures work carried through to a completely satisfactory conclusion.

THE Atlas Mineral

PRODUCTS COMPANY OF PENNA.

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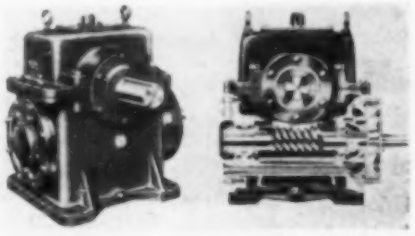
*DENVER 2, Colo., 1921 Blake St.
*HONOLULU 2, Hawaii, U.S.A.
OMAHA, Neb., 423 South 38th Ave.
*LOS ANGELES 12, Cal., 172 S. Central Ave.
NEW ORLEANS 12, La., 208 Vincent Bldg.
*SEATTLE 4, Wash., 1252 First Avenue, S.

*Stock carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal 3, P. Q., 86 Bloor St. W., Toronto, Ont.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

continuous loop of piping 275 ft. long through which the coal and air mixture from a single pulverizing unit circulates continuously to the plant's four rotary kilns. The system was designed for simultaneous firing of two kilns with a peak fuel demand of 15,240 lb. of pulverized coal per hour, but under normal conditions will meet the requirements of three kilns at once. This installation has indicated the practicability of employing loop lengths up to 1,000 ft. and suggests the value of the system for direct firing where there are many furnaces of small capacity located some distance apart.



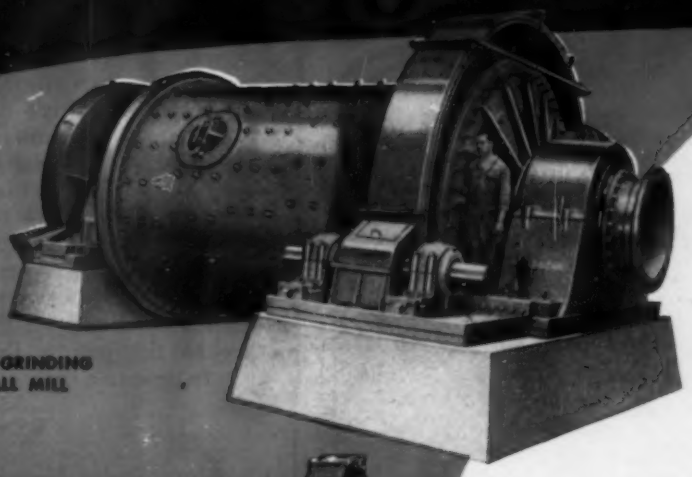
15. Worm Gear Reducers

INTRODUCTION of a new line of inclosed worm gear drives, made in both horizontal and vertical types, has been announced by Foote Bros. Gear & Machine Corp., 5301 Southwestern Blvd., Chicago, Ill. Owing to improved cooling of the oil by a built-in fan which drives high-velocity air through a channel immersed in the oil reservoir, these reducers are smaller in size than conventional drives of equal capacity. Increased load-carrying ability is claimed for the gears, which are generated by a new technique. Oil leakage is said to be prevented by the use of a carbon lapped-ring type seal. These units are produced in a wide range of standard ratios, complying with standards adopted by the American Gear Manufacturers Association and the National Electric Manufacturers Association.

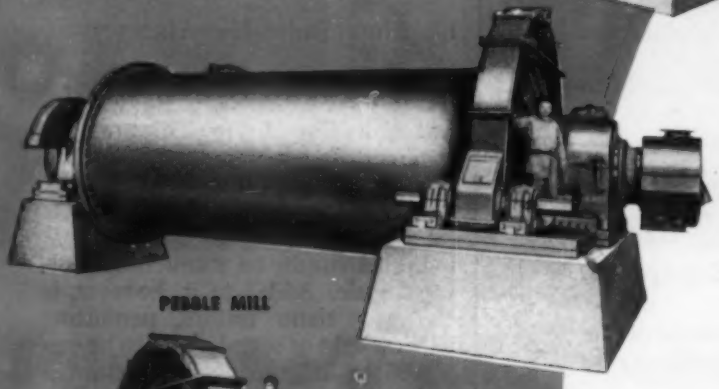
16. Controller Auxiliary

WHAT IS KNOWN as an "inverse derivative" unit has been developed by Moore Products Co., H and Lycoming Sts., Philadelphia 24, Pa., for use with this concern's Nullmatic controllers. The device is intended for

NORDBERG GRINDING MILLS

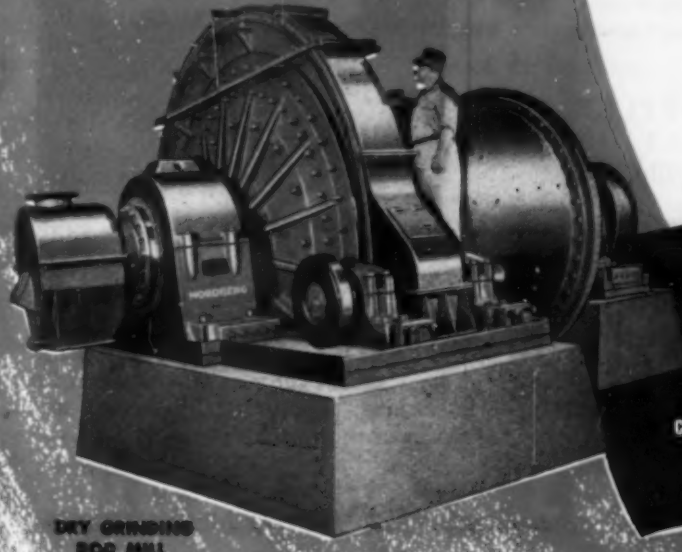


WET GRINDING BALL MILL



PEBBLE MILL

COMPARTMENT MILL



DRY GRINDING ROD MILL

. . . for wet or dry grinding operations

Whether you are building a new plant, expanding your milling operations or replacing obsolete equipment, there is a Nordberg Grinding Mill that will meet your requirements. Ball, Tube, Rod, Pebble and Compartment Mills are offered in various diameters and lengths, for open or closed circuit operation with screens, classifiers, or air separators. If you have a grinding problem or are in need of additional equipment, write for information about what Nordberg has to offer.

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NORDBERG MACHINERY

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for processing ores and minerals

Crushers • Grinding Mills • Kilns • Coolers • Feeders
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Blower questions answered
Centrifugal Blower of 19,150 CFM capacity, driven by 200 HP steam turbine.
Rotary Positive Blower of 12,500 CFM capacity, with direct-connected motor drive.

by R-C dual-ability

When you put your blower questions up to Roots-Connersville, you gain these important advantages:

1. Long experience in the adaptation of blowers to needs of the chemical industry, coupled with the forward-thinking of our alert engineers.
2. Our *dual-ability* to supply either Rotary Positive or Centrifugal Blowers, whichever type is best fitted to the specific work.
3. A wide range of standard capacities, from 5 CFM to 50,000 CFM (or higher), adapted to any modern drive, which makes for lower prices and faster deliveries than "special" designs.

Finally, when you have selected the R-C Blower that satisfies your requirements, you can be certain of sound, sturdy construction, low maintenance and operating costs, and a long life of profitable performance. For accurate answers to your blower questions, consult us.

In 1858, when the Atlantic Cable carried its first message, "Roots" had been building blowers for four years, since 1854. We're not good because we're old, but old because we're good.

ROOTS-CONNERSVILLE
BLOWER CORPORATION
812 Illinois Ave., Connersville, Ind.

ROOTS-CONNERSVILLE
ROTARY CENTRIFUGAL
BLOWER BUILDERS R-C SINCE 1854
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS

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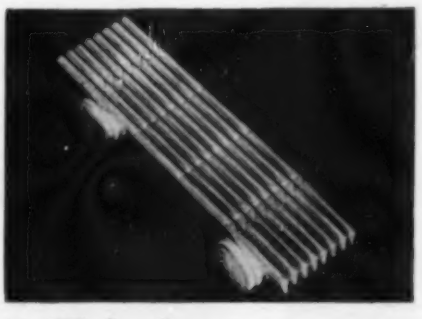
application on processes in which the reaction time through the process is faster than the correction time through the control valve. Its function is to superimpose on the output of the controller a new type of control action which the manufacturer terms as "inverse derivative." It is applicable in general to fluid flow, pressure and liquid level applications which have small capacities. Its purpose is the reverse of the "direct derivative" function which is employed in applications where the control valve can move much faster than the process can change. Where direct derivative action temporarily narrows the proportional band, reverse derivative action temporarily widens this band. Where direct derivative action tends to amplify the tendency to cycle in fast operating processes, inverse derivative action will temporarily widen the proportional band and act to restore stability to the process the instant it tends to go into a cycle.

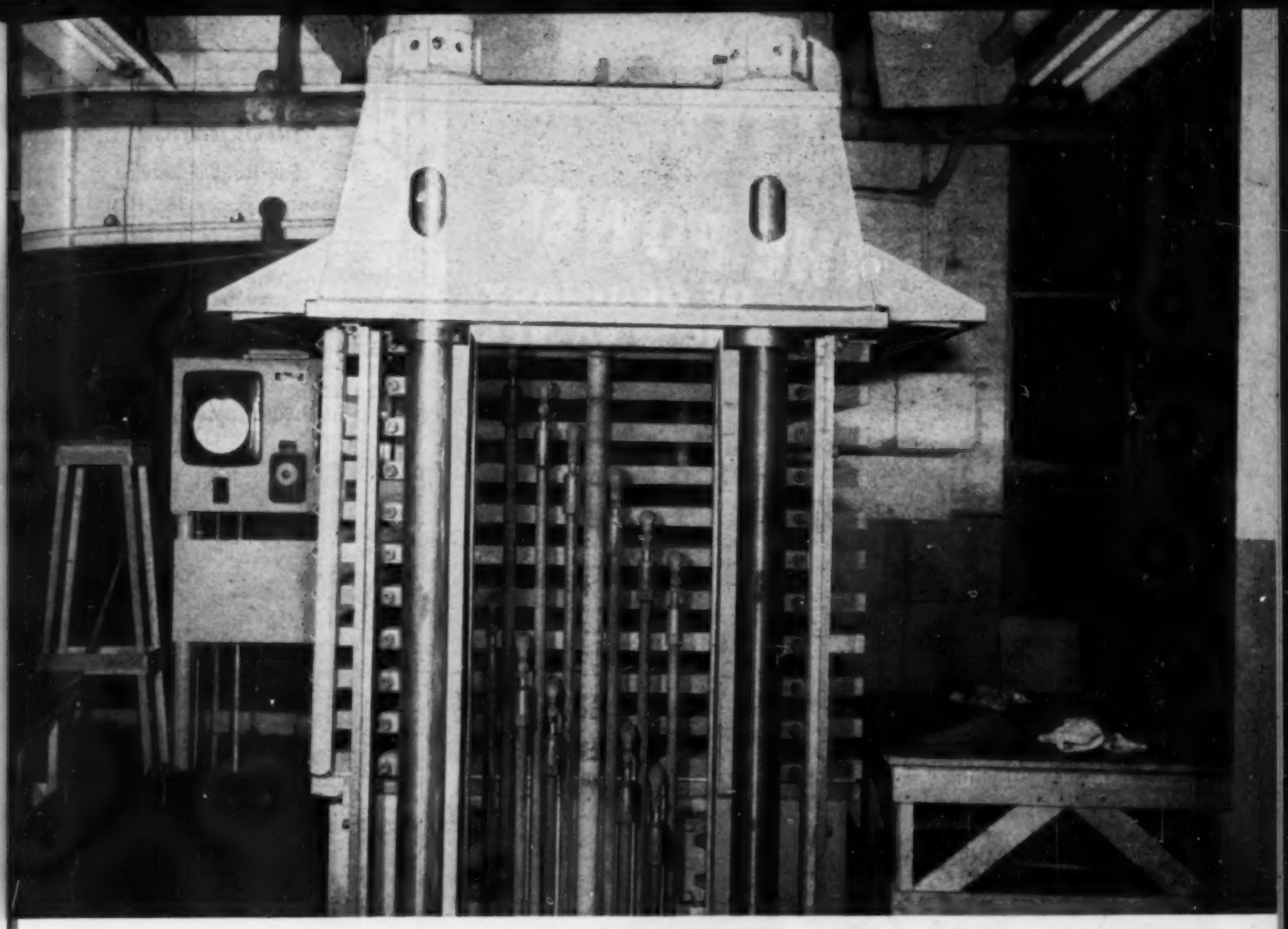
17. Flow Indicator Alarm

AN AUTOMATIC electric alarm system is now available as an integral part of its line of flow indicators, according to an announcement of the Henszey Co., Watertown, Wis. The flow indicator retains the same features as formerly, with the flow rate indicated visually on a uniformly graduated scale. Added to it, however, is the new alarm feature, permitting either a light or sound alarm to be employed to indicate desired maximum and minimum rates of flow. The alarm feature may be set to indicate a very slight deviation from desired flow, or will operate over a wide range, as desired.



18. Wedge Screen

OPERATING under the patents of the British Wedge Wire Co. Ltd., the Cambridge Wire Cloth Co., Cambridge, Md., is now offering wedge wire screens for use on equipment for washing, dewatering, classifying and similar purposes. These screens can be fabricated in any length or width



Solves heat-and-water problem...

Lubrication of the telescopic steam joints on a hot-plate veneer press was a continual problem for a midwest furniture manufacturer. The job required a grease that would withstand temperatures of 240° to 260°F. and the severe washing action of steam and water.

Conventional greases failed to meet these requirements. Joints had to be lubricated frequently. This interfered with production and resulted in excessive consumption of the lubricant.

A Standard Oil Lubrication Engineer suggested that Stanolith Grease No. 57 be used. This is a lithium soap product capable of standing up under high temperatures and of resisting the washing action of water. Since the switch to "Stanolith," the joints have been lubricated between shifts with no interruption of production. Lubricant consumption has been reduced 40%.

Stanolith Grease No. 57

Where the combination of heat and water causes lubrication difficulties, try Stanolith Grease. A Standard Oil Lubrication Engineer will be glad to give you more data on this versatile product. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the engineer nearest you.

STANDARD OIL COMPANY (INDIANA)

STANDARD

6 times THE POWER OF ORDINARY SOLENOID VALVES

GENERAL CONTROLS
K-10 SERIES
ELECTRO-MAGNETIC
LEVER VALVES

CONTROLS: LIGHT AND HEAVY OILS, AIR, WATER, GAS, STEAM, REFRIGERANTS, etc. Suitable for pressures up to 1000 pounds and temperatures up to 400° F.

SIX TIMES THE POWER of ordinary solenoids assures high seating pressure and overcomes the blocking effect of viscous fluids, such as heavy fuel oil. Adequate power of solenoid insures positive operation. Normally closed or open types available.

Internal valve assembly can be removed for cleaning and inspection if necessary. Two-wire—A.C. or D.C.—current failure—packless construction—bronze body—stainless steel and bronze internal parts—soft seats available.

FOR COMPLETE SPECIFICATIONS request new Catalog

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Manufacturers of Automatic Pressure, Temperature, Level & Flow Controls

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Designed for Interstate Transportation

HERCULES Aero (RUBBER CUSHIONED) CARBOY BOXES

- CHEMICALS
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Specifications:

SIZE: 17½"x17½"x22"

WEIGHT: Approx. 45 lbs. without bottle.

CARBOY: 13 gallons.

HERCULES CORK-CUSHIONED CARBOY BOXES NOW AVAILABLE!

Other Carboys available in 5 and 6½ gal. sizes.

COMPLIES WITH CLASSIFICATION I.C.C. 1-A

NATIONAL BOX & LUMBER COMPANY

HOME OF HERCULES CARBOY BOXES • NEWARK 5, N. J.

FOR MORE INFORMATION
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required, from a wide variety of metals and alloys, including stainless steel. They feature greater freedom from clogging owing to the wedge-shaped cross-section of the screen wires, and to the accuracy of opening maintained by the method of fastening the wedge wires together with cross rods passing through loops formed at regular intervals. Screens are produced with two types of surface, a flat surface and a riffle surface, the latter shown in the illustration. The slight irregularity in this surface is said greatly to aid in removing water content from materials processed on the screen.

Equipment Briefs

19. To FACILITATE quick and accurate layout of process flowsheets, Rapidesign, Inc., P. O. Box 592, Glendale, Calif., has introduced its new No. 44 process template which includes all the commonly used processing symbols. Made from cellulose nitrate sheet, the template is printed on the reverse side to prevent wearing off. Symbols are available for towers, stills, vessels, vessel tops and bottoms, mixers, valves of various kinds, agitators, heating coils, and a variety of other purposes. These symbol cutouts provide an allowance for the width of the pencil point. The template is 5 x 8 in., and its corners are cut in segments of circles ranging from ¼ to 1 in. in ¼-in. increments.

20. DEHUMIDIFICATION of room air in capacities up to 5,000 cu. ft. per unit is possible with a new small dehumidifier offered by the Dryomatic Corp. of America, Room 920, 120 Wall St., New York, N. Y. These units, which have been used successfully by the Army and Navy in lay-up of equipment, are said to be capable of holding a dew point of 0 deg. F., and a relative humidity of 15 percent, if desired. The chemical moisture adsorber is automatically dried out completely in a 30-min. heating cycle when it becomes saturated. Electric heat is used for this purpose. The machine is automatically controlled to maintain desired humidity, and each small unit is capable of removing 1 gal. of water per day at 70 deg. F., and 50 percent relative humidity.

21. SERVICE at pressures as high as 1,000 to 10,000 psi. is possible with a

ALLIS-CHALMERS

"Certified" Service

A BREAKDOWN on this 39-year-old Allis-Chalmers fan motor crippled operations at the plant of an important midwest electric utility. Immediate repair was vital. The Chief Engineer called the nearest Allis-Chalmers Certified Service shop. They picked up the rotor and returned it ready for service in less than twenty-four hours.

This is the kind of emergency cooperation you can expect from every Allis-Chalmers Certified Service shop. On everyday repairs and maintenance too, your Allis-Chalmers Certified Service shop will give you prompt service on Allis-Chalmers motors, pumps and transformers, using factory approved methods and parts. Every Allis-Chalmers Certified Service shop has been selected for skilled, personal, careful workmanship, adequate equipment and *service mindedness.*

HOW TO FIND NEAREST SERVICE SHOP

Allis-Chalmers Certified Service shops are located in major industrial centers throughout the country. New shops are being appointed continuously and most smaller centers will soon be covered. To find the shop nearest you, call your closest Allis-Chalmers District Office.

A 2543

MOTOR DELIVERIES GREATLY IMPROVED

Many types of Allis-Chalmers Motors are now in stock! Many other types are available on short delivery! For motors from 1 to 200 HP, check your nearest Allis-Chalmers Authorized Dealer. For motors larger than 200 HP, check with the nearest District Office. You may be able to get what you need sooner than you think.

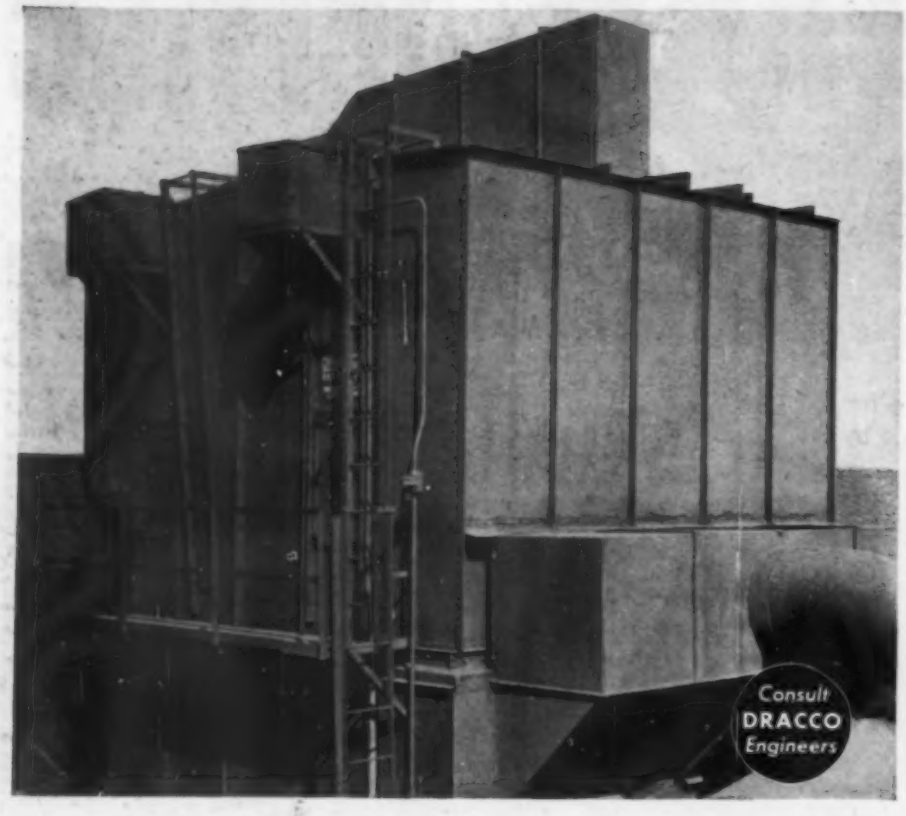
ALLIS-CHALMERS, 1147A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

DRACCO DUST CONTROL

always Saves Money



There is no question about the possibility of getting a good return on money invested in DRACCO Dust Control — in many cases the returns are enormous, especially where valuables are recovered. Dust, even in small quantities, should be eliminated because it is destructive in many ways. DRACCO Dust Control prolongs useful life of equipment, reduces maintenance, creates better working conditions and increases plant efficiency. Dust ALWAYS costs money — DRACCO Dust Control ALWAYS saves money. DRACCO Engineers have over 30 years experience in dust and fume control. Why not consult them?

For Further Information Write

DRACCO CORPORATION

4071 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

new line of high-pressure filter units offered by the Micro Metallic Corp., 193 Bradford St., Brooklyn 7, N. Y. These units employ porous stainless steel filter media in containers of carbon or stainless steel construction. Typical applications include high-pressure clarification in rayon manufacture, removal of solids in hydraulic systems, and removal of small particles of graphite derived from graphite-lubricated compressors in liquid air manufacture.

22. To FACILITATE welding at various points in the plant, Automatic Transportation Co., 147 W. 87th St., Chicago, Ill., has introduced an adaptation of its well-known Transporter electric hand truck, consisting of a Transporter chassis, plus a rack in which are mounted all tanks, rods, tools, and essential equipment for acetylene welding. Space is also provided for a fire extinguisher. In addition, the unit serves as a tractor to pull an electric welder.

23. A NEW LINE of armored porcelain valves, employing an armoring of acid-resisting, heat-treated silicon aluminum, has been announced by the Process Equipment Division of Lapp Insulator Co., Le Roy, N. Y. All parts in contact with the chemicals handled are of porcelain. The armoring provides protection for personnel and equipment against porcelain breakage from carelessness or accident. Valves of the Y type are available in sizes from 1 to 6 in., angle valves in 1- and 2-in. sizes, and flush valves in 1½- to 3-in. sizes for 3- to 5-in. tank outlets.

24. A PRACTICAL device for dispensing chemicals and other liquids from standard 5-gal. cans, known as the Klix Speedy Spigot, has been announced by the Scientific Glass Apparatus Co., Bloomfield, N. J. This device, made by the Klix Co. of East Orange, N. J., is made principally of copper, cadmium plated for corrosion resistance. A distinctive feature is an air inlet tube equipped with a ball valve which allows free passage of air into the can, yet seals the vent against escape of liquids and vapors. A valve operated by a thumb button controls the flow. The device is said to eliminate all splashing and waste.

25. To ELIMINATE excessive vibration caused by pulsation, Benson & Associates, 536 South Clark St., Chicago 5, Ill., has announced a Fluor pulsation dampener for installation on the suction and/or discharge side of compressors. The device is said to reduce maintenance and increase safety through lessening the possibility of metal fatigue, while at the same time it makes working conditions better.

To insure the efficiency of operation intended in the original design

NOTHING EQUALS STAINLESS STEEL

A STAINLESS STEEL of the U·S·S 12 type was used by the A. O. Smith Corporation, Milwaukee, in this ¼" lining for a giant fractionating tower, 116 ft. long by 16 ft. in diameter, recently built for a Chicago area refinery.

Here is a typical application of U·S·S Stainless which, by lengthening the on-stream periods and speeding up turn-around time, fully justifies its selection.

U·S·S Stainless Steels are available in a wide variety of analyses to meet practically any requirement of oil refinery service. But it is well to remember that these steels have different physical characteristics which must be thoroughly understood if Stainless is to give optimum results both in fabrication and in on-the-job performance. For that reason, expert advice on the selection and on the fabricating methods employed is vitally important. This we are prepared to furnish.

Our Stainless engineers are specialists in the use of Stainless Steel. Ask for their co-operation. You'll find their suggestions practical and extremely helpful not only in determining what grade of U·S·S Stainless will do the best job for you, but in showing how it can be handled most efficiently through the fabricating shop.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO · CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
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UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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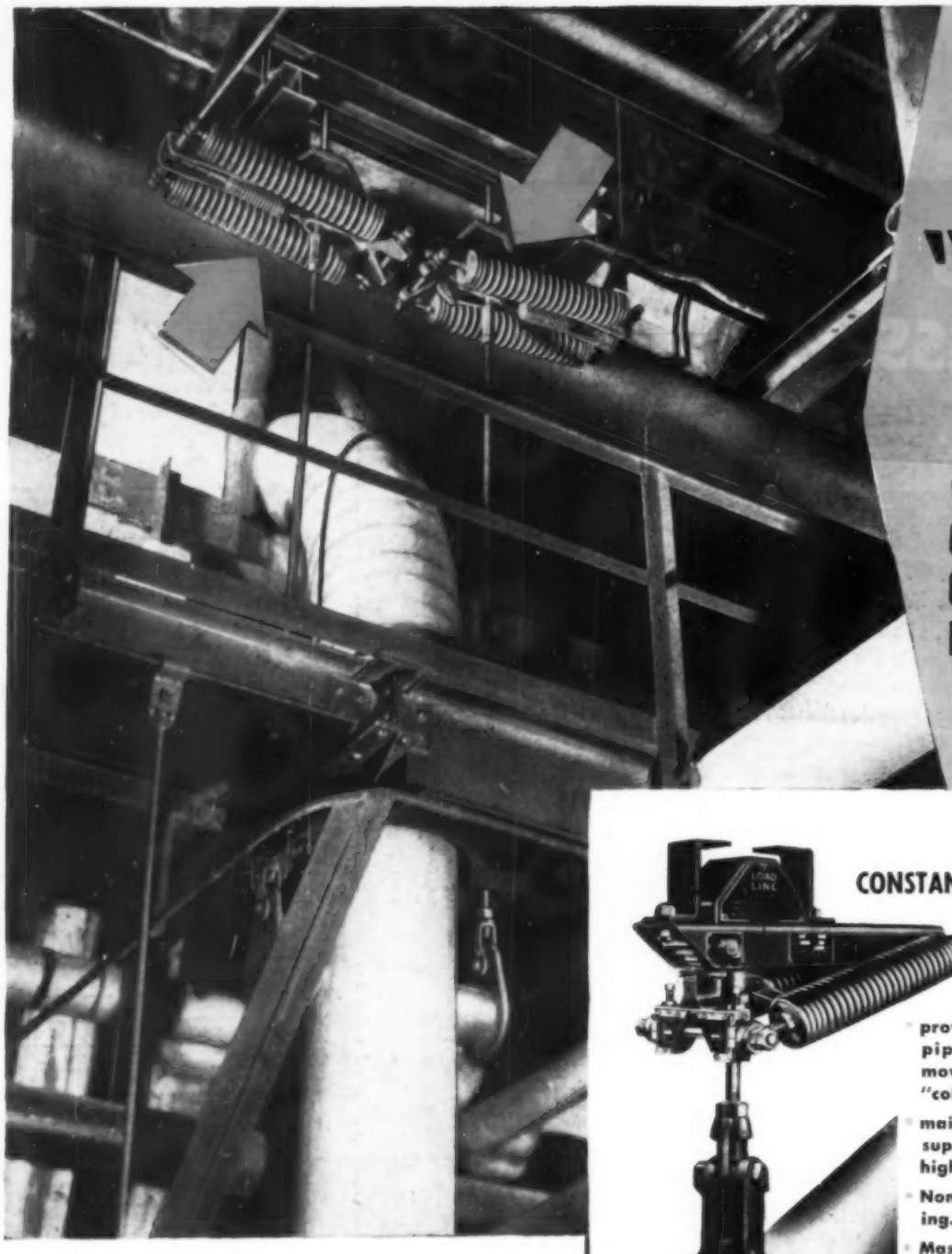
U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

8-1607

UNITED STATES STEEL



BIG "CAT" TAMED

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In one of the largest catalytic cracking plants for gasoline, Grinnell Constant-Support Hangers provide constant support for trunnion-supported vertical piping weighing 8,000 lbs. with 4" vertical movement at 1100° temperature.

Write for data book, "Grinnell Constant-Support Hangers", containing complete details.

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GRINNELL CONSTANT-SUPPORT HANGER

the ONLY constant-support pipe hanger

- provides constant support to piping subject to vertical movement—in all "hot" and "cold" positions.
- maintains full safety factor in supporting high temperature, high pressure piping.
- Non-resonant, energy absorbing.
- Mass-produced from standard precision parts.
- Individually calibrated for each installation.
- Load-adjustment features incorporated into design.
- Three models meet entire range of load-travel specifications.
- Minimum headroom required.

GRINNELL

WHENEVER PIPING IS INVOLVED

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NEW *Chemical Engineering* TOOLS

PRODUCTS AND MATERIALS • PROCESS EQUIPMENT • MANUFACTURERS' LITERATURE

Use these handy Reader Service cards for more information on this month's new products and equipment or for copies of latest trade literature.

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MANUFACTURERS' PUBLICATIONS

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101. Polyisobutylene. Enjay Co., New York, N. Y.—48-page bulletin describes processing and compounding of Vistanex, the polyisobutylene compound produced by this company. The types of material available, methods of addition to other elastomers, and other uses such as tank lining, emulsions, caulking compounds,

OVER

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and adhesives are included. Physical properties of Vistanex are given and an extensive bibliography is appended.

102. Welding Outlets. Bonney Forge & Tool Works, Allentown, Pa.—New 20-page catalog presents complete information on the line of welding fittings produced by this company. The fittings include those for butt welding, socket welding, and threaded outlets. Engineering data on the fittings are given including sizes, dimensions, weights, temperature-pressure ratings, and material specifications. List prices are also given.

103. Boxes. General Box Co., Chicago, Ill.—12-page brochure illustrates the different types of boxes produced by this company and illustrates methods of using them in packaging various types of products. Both fiber and wood boxes are included as are wire-bound crates.

104. Organic Chemicals. Matheson Co., East Rutherford, N. J.—A new edition has been published of the price list of the Paragon Division of this company listing some 1,500 organic chemicals which this company manufactures, refines or sells. Prices are shown for two different sizes of purchase for each item.

105. Expansion Joints. Cook Electric Co., Chicago, Ill.—This new 12-page bulletin gives data on the series of standard expansion joints produced by this company. The units are flange-type bellows, hence giving an expansion joint that requires no reinforcing rings or guide rods. The bulletin lists complete dimensions of the standard units produced in copper, stainless steel and Monel. Other types illustrated include offset expansion joints for cases of pipe misalignment.

106. Steel Tubing. J. T. Ryerson & Son, Inc., Chicago, Ill.—32-page bulletin gives engineering data on the various types of pipe produced by this company. Included are both carbon and stainless steel. Both seamless and mechanical welded tubing are described.

107. Industrial Belting. Hewitt Rubber Div., Buffalo, N. Y.—16-page bulletin describes various types of continuous rubber-coated belts. Both power transmission and conveyor belting are included. Applications considered include general industrial, agricultural, coal mine, and food processing. Accessories are also described.

108. Cast Iron Pulleys. Strout, Waldron & Co., Muncy, Pa.—16-page bulletin No. P-848 describes this company's line of cast iron pulleys. Complete dimensions and list prices are given. Rubber-covered and wing-type pulleys are also included.

109. Nickel Alloys. International Nickel Co., New York, N. Y.—24-page bulletin entitled "Standard Specialties" illustrate the various forms in which Monel, Inconel and nickel are produced by this company. Some of the various types of fabricated equipment shown include castings, containers, wire cloth and tower packings.

110. Condenser Tube Inserts. Condenser Service & Engineering Co., Hoboken, N. J.—8-page bulletin describes the application of Flowrite metal inserts into the ends of condenser tubes in order to reduce tube failures due to erosion. Engineering data showing the results of such installations are included.

111. Unit Heater. Lee Engineering Co., Youngstown, Ohio—This 4-page brochure illustrates applications for the direct-fired unit heaters produced by this company for heating interiors of large buildings. The units may be fired by oil, gas or coal. Individual heater capacities can be supplied from 750,000 to 1,500,000 Btu.

112. Automatic Controls. Leeds & Northrup Co., Philadelphia, Pa. — 40-page catalog MD4A(1) describes the position-adjusting type automatic control produced by this company. Applications are shown for regulating such things as tem-

(Continued on page 302)

These are good for items in this issue only and must be returned by February 28, 1949.

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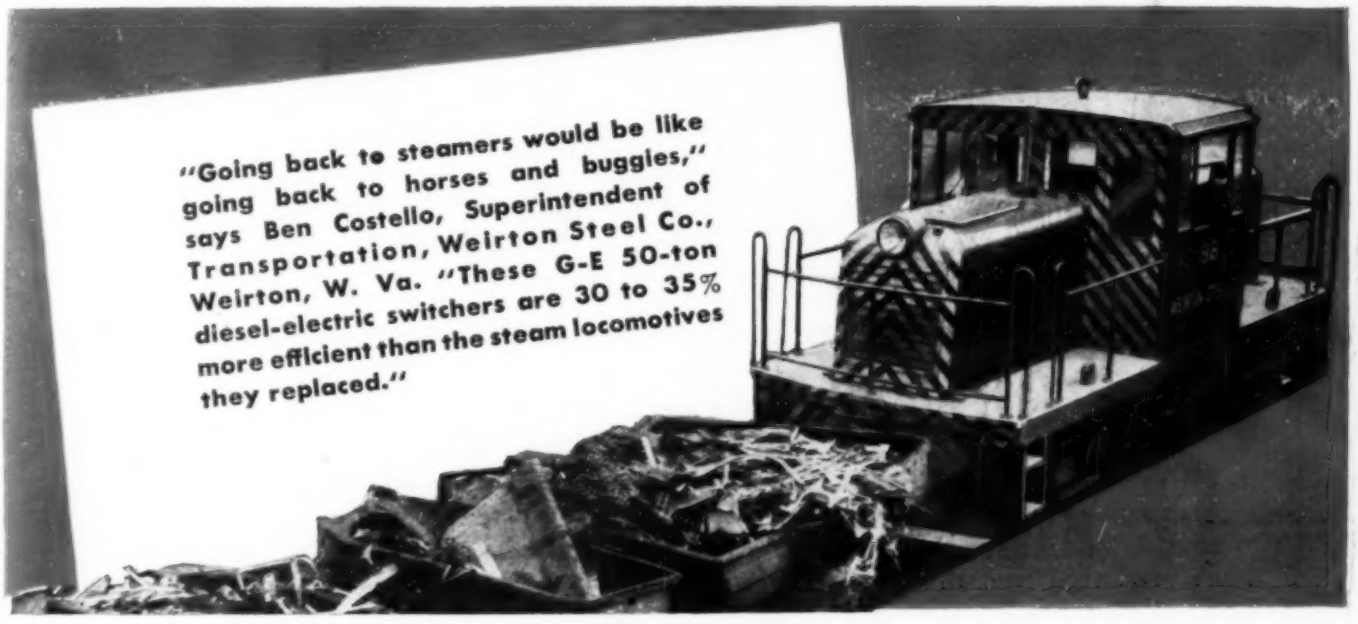
Goodbye "Horse-and-Buggy" Switching


"Going back to steamers would be like going back to horses and buggies," says Ben Costello, Superintendent of Transportation, Weirton Steel Co., Weirton, W. Va. "These G-E 50-ton diesel-electric switchers are 30 to 35% more efficient than the steam locomotives they replaced."

97% Availability

High-efficiency switching at Weirton is due to several reasons. The five peppy 50-tonners have an average availability of over 97 per cent, while the coal-burning steam locomotives they replaced were available for service 60 per cent of the time. Each diesel-electric is out of service only 20 minutes every three days for refueling, each steamer required 90 minutes refueling time every eight hours.

Working hours are long—24 hours a day, seven days a week; the loads are heavy—up to 573,000 lbs; but the husky G-E locomotives are brim full of get-up-and-go. They have the power and the pull to get the job done.

Five Standard Sizes

If you're using old steam or gasoline locomotives in your switching operations, you can expect to save thousands of dollars a year through slashed fuel and maintenance costs. G-E has five standard locomotive sizes, any one of which will probably pay for itself in three or four years. Have your nearest G-E representative survey your requirements, estimate your savings in advance. There's no obligation. Apparatus Department, General Electric Co., Schenectady, N. Y.

LOW FUEL COSTS

Diesel-electric locomotives burn approximately one gallon of fuel oil, where a steam locomotive burns one hundred pounds of coal. This is one reason why G-E switchers often pay for themselves in three or four years.

Switch to GE Diesel-electrics *And Save!*

GENERAL ELECTRIC

120-43

THEY'RE HERE RIGHT NOW

coming in 1949 from the

BIGGEST show on earth!

(!!! MORE STUPENDOUS THAN EVER !!!)

3 center-ring features IN A MAMMOTH 3 RING CHEMICAL CIRCUS 3

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FERMENTATION BUTYLS!

BUTYL ACETATE — **BUTANOL** — **DIBUTYL PHTHALATE**

1949 is a NEW YEAR! a DIFFERENT year . . . so **NOW** ask yourself these momentous questions!

1—Have I checked on CSC Butyls lately? (BETTER DO IT RIGHT AWAY!)

2—Is it now possible for me to return to pre-war quality?

CHECK NOW—PLAN FOR THE FUTURE—WITH

COMMERCIAL SOLVENTS CORPORATION

17 EAST 42nd ST. NEW YORK 17, N. Y.

NEW PRODUCTS AND MATERIALS

Joseph A. O'Connor, ASSISTANT EDITOR

Reference fluid ignites in simulated hot manifold test . . .

. . . Skydrol doesn't.

51. Skydrol

A JOINT development of the Douglas Aircraft Co., Inc., of Santa Monica, Calif., and the Monsanto Chemical Co. of St. Louis, Mo., is a new fire-resistant hydraulic fluid for aircraft. It was developed for use in cabin superchargers, expansion turbines for air-conditioning systems and in the hydraulic system itself. The fluid is used to activate the mechanism that controls such devices as the retractable landing gear, brakes, wing flaps and even windshield wipers.

The hydraulic system is usually operated either by gear or piston pumps. At high flow rates, it develops pressures upwards of 3,000 psi. Because high-pressure hydraulic systems on aircraft may spring leaks, non-flammability is one of the most desired characteristics in a hydraulic fluid. A leak causes the fluid to be expelled as a fine mist. A flammable fluid may catch fire from exhausts, from contact with the hot manifold or from sparks in the electrical system. The aviation industry has long sought a non-flammable hydraulic fluid.

Autogenous ignition point of Skydrol is 1,050 deg. F. The high lubricating power of Skydrol greatly extends the service life of pumps and other working parts of the hydraulic system. Lubricity of Skydrol is at least double that of most hydraulic fluids now used. It has a viscosity index of 160, assuring only a small viscosity change over a wide range of temperatures. Skydrol operates satisfactorily at temperatures down to −40 deg. F.

This new hydraulic fluid will not attack aluminum, magnesium, aircraft bearing alloys, copper, steel or other structural metals. Chemically, it is virtually inert. Skydrol is an ester base compound and does not contain halogenated hydrocarbons or salts. It does not deteriorate in service and hence does not result in corrosive breakdown products. It will be necessary to replace natural and synthetic rubber packing and gaskets where volume changes are objectionable, however, since Skydrol causes swelling. Should it leak on adjacent electrical insulation, Skydrol would tend to soften the insulation. But nylon insulation will prevent such softening.

Some 78 formulas were studied in the laboratory and 28 fluids were subjected to extensive tests in hydraulic systems before the best compound was discovered. Under a joint agreement, Douglas will continue development work and inaugurate an operational test program, while Monsanto will produce and distribute the new hydraulic fluid.

52. Modified Polyacrylic Ester

Manufacture of Lactoprene EV, a modified polyacrylic ester, is announced by B. F. Goodrich Chemical Co. This material is an experimental product developed by the Eastern Regional Research Laboratories of the Department of Agriculture. To be redesignated as Polyacrylic Ester EV, it will complement other nitrile and polyacrylic ester type rubbers now made by B. F. Goodrich. It is now available in pilot-plant quantities only.

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FOR MORE INFORMATION
See Reader Service Coupon on pages 159-160

New press for new plastic.

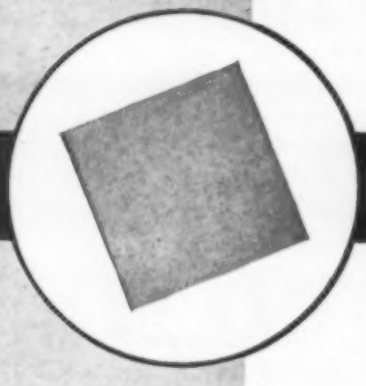
53. Alkyd Plastic

DEVELOPMENT of a new mineral-filled, quick-setting plastic material, designated as Plaskon Alkyd molding compound, has been announced by the Plaskon Division of Libbey-Owens-Ford Glass Co., Toledo. This new

NEWARK WIRE CLOTH

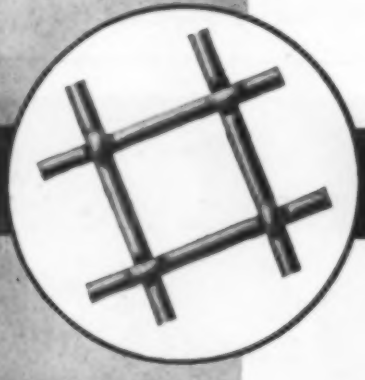
NEWARK for ACCURACY

Best by Test for



FINE POWDERS

Newark—precision manufacturers of Wire Cloth and Wire Cloth Fabricated Products—has a complete selection of wire cloth available! For sifting everything from fine powders to large lumps, we have the proper mesh wire cloth.



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Securely double-crimped, extremely accurate and, if desired, highly-corrosion resistant, NEWARK WIRE CLOTH will meet your most exacting standards.

Newark Wire Cloth COMPANY

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alkyd plastic will broaden the field for utilization of plastic materials. It is an entirely new product, in no way replacing other materials now on the market. It opens the way for ultra-high-speed compression molding as thermoplastic compounds gave greater emphasis to the development of injection molding. The most significant characteristic of the new material is its rapidity of cure, the molding process being measured in seconds. It can be utilized in less-massive, high-speed molding machines. Plaskon Alkyd differs from other thermosetting plastics in that it possesses unusual electrical characteristics, high heat resistance, low moisture absorption, unusual dimensional stability and unique molding properties.

Since it is a mineral-filled material, the tensile, flexural and compressive strengths of Plaskon Alkyd are somewhat lower than those of cellulose-filled thermosetting plastics. Because of its heat resistance, however, the alkyd compound maintains its strength properties at temperatures at which most other compounds fail. The modulus of elasticity is substantially higher than in other compounds. Shrinkage and water absorption properties are in the range of phenolics and superior to amino resin compounds. Plaskon Alkyd's resistance to high temperatures compares favorably with that of the best phenolics. An ASTM test showed its heat distortion point to lie between 300 and 400 deg. F., but the product does not change appreciably at higher temperatures. For short periods of time it may even be exposed to higher temperatures without serious effects. Constant exposure to 300-400 deg. F. temperature range leaves its properties unaffected. Low temperatures likewise have no undesirable effects. Parts molded of alkyd material are resistant to all common organic solvents and to strong and weak acids.

The most significant characteristic of the material is the rapidity of cure. Thin sections cure satisfactorily at 300 deg. F. in a matter of seconds. This temperature is optimum for typical operation. However, it may be as low as 275 deg. F. or as high as 350 deg. F. The curing time is so short that factors other than the nature of the material influence it to a large degree. A 2 in. by $\frac{1}{8}$ in. disk cures well in 12 sec. at 300 deg. F. Lowering the temperature 10 deg. F. increases the time markedly. Because of this speed of curing it is essential that the mold be closed rapidly. This may eliminate the use of some standard slow-closing molding machines, but the other molding characteristics more than compensate for this change. Required pressure depends to a large extent on the conformation of the piece and the mold

Christmas Greetings
and Sincere Good Wishes
for a Happy and
Successful New Year!
HEYDEN CHEMICAL CORPORATION
NEW YORK I, NEW YORK

PUMPING *Hot Viscous Liquids*

Sulphur

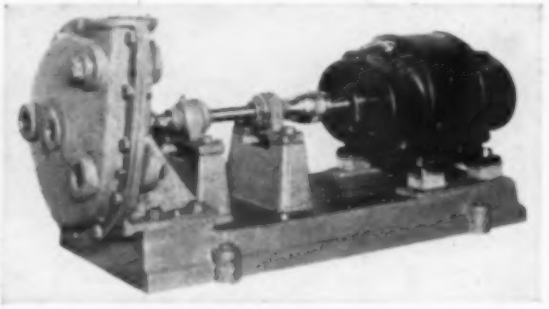
Molasses

Glue

Tar

etc.

Many heavy, viscous liquids can be pumped only at high temperatures. Sulphur, for example, if not kept hot enough, would solidify and clog the system. To meet difficult requirements such as this, Lawrence engineers design steam-jacketed centrifugal pumps for the specific liquid and temperature range involved. Illustrated is a regular side-suction pump entirely enclosed in a steam jacket which also covers the intake and stuffing box. The pump and liquid within are kept at the steam temperature. Write us the details of *your* pumping problem. We'll be glad to discuss it with you—without obligation.



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LAWRENCE

MACHINE & PUMP CORPORATION

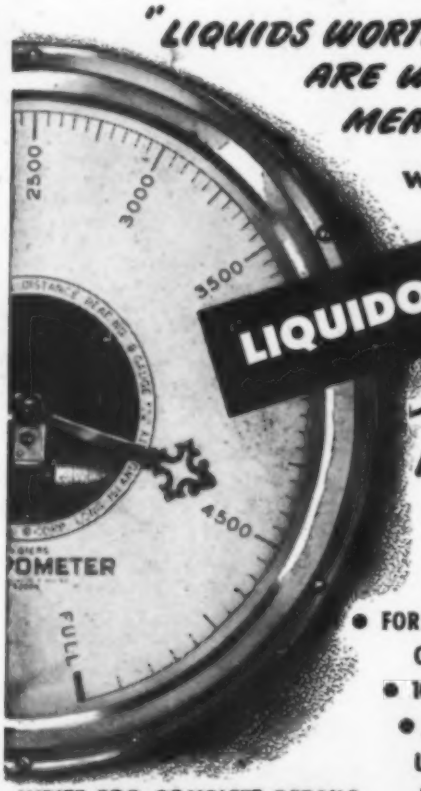
369 MARKET STREET, LAWRENCE, MASS.

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

with a

LIQUIDOMETER

Tank Gauge



- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.

36-29 SKILLMAN AVE., LONG ISLAND CITY, L.I., N.Y.

design. It ranges from 400 to 2,000 psi. The optimum pressure of 500 to 900 psi. is also lower than usual with thermosetting material.

The chemical reaction which causes the cure of the material in the mold seems to continue automatically with its own heat for a short time after the heat is removed from the mold. When the cure is complete the chemical reaction stops. This is important since it reduces the possibility of undercured pieces. If the piece can be easily removed from the mold and there are no blisters or soft spots on it, the piece is adequately cured. It will usually take 5 to 10 sec. for a piece about $\frac{1}{8}$ in. thick to cure. Pieces of $\frac{1}{2}$ in. or thicker will take about 30 to 80 sec. With the alkyd compound there is no danger of over-curing, since the heat resistance of the molded material when cured is higher than the mold temperature.

The requirements of less heat, less pressure, faster operations and less control of curing demanded by the new material mean that molding machines can be less massive, less expensive, faster and more easily operated. Air pressure rather than hydraulic pressure can be used, thus reducing the size and cost of the machine as well as making it less troublesome to operate. The machines will be more economical to operate due to the speed of production possible.

Plaskon Alkyd molding compound is offered as particularly suitable for electrical and mechanical applications. In general, it has excellent electrical properties, particularly in its resistance to tracking when exposed to an arc. Its arc resistance when tested under the standard ASTM procedure is 190 to 200 sec., whereas the next best standard material yields top values of about 140 sec. The electrical properties are maintained to a high degree even after immersion in water or long exposure to moisture.

Most applications of the new compound are in electrical connectors, switch units and similar parts. A number of these have been thoroughly tested and are now in limited commercial production.

54. Disinfectant Emulsion

Two MINUTE preoperative scrub time in operating rooms is today bacteriologically feasible. The disinfecting action of pHisoderm fortified with 3 percent chlophane has made this advance possible. Chlophane is a new chemical also known as G-11 and hexachlorophene.

pHisoderm, a free-flowing emulsion, contains sodium octylphenoxyethoxyethyl ether sulphonate, lanolin cholesterols and petrolatum. It was

CLOSES MULTIWALLS

"clam-tight"

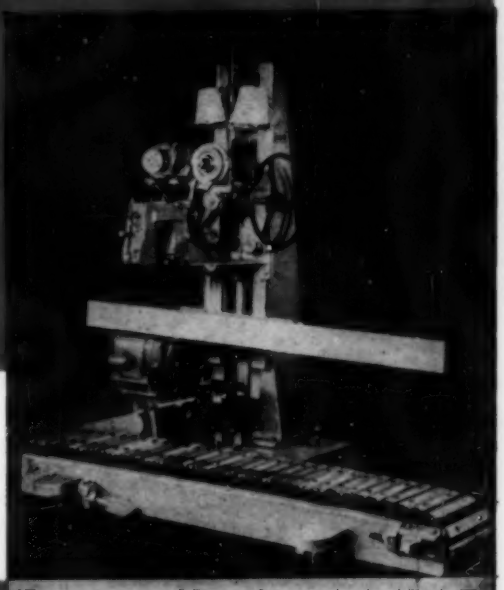
AT HIGH SPEEDS!

Your packaging time drops sharply when you're operating with a BAGPAKER.® Picture the savings from a machine that closes up to 15 heavy-duty multiwall paper bags per minute—a rugged long-lasting machine, too! And there's more than enough strength in a tough BAGPAKER closure. It's made with the "cushion stitch", which absorbs strains and won't pull out.

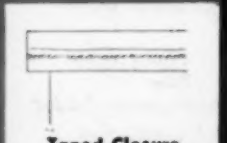
Check the features of both BAGPAKER models shown at the right. One provides high speed, dependable closing; the other, in addition, gives a closure that resists moisture and is proof against contamination and sifting.

You're apt to discover more profitable closing and handling methods . . . more efficient multiwall bag uses, by discussing your needs with a BAGPAK engineer.

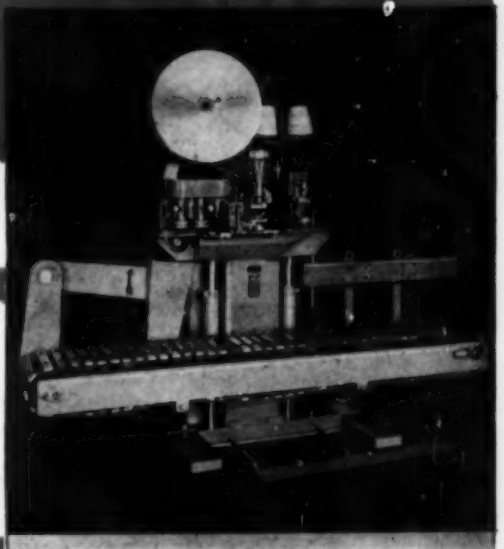
The famous BAGPAK® "cushion stitch"



MODEL "E 1" (portable)—closes up to 15 bags per minute. A single foot pedal controls both conveyor and sewing head. Handles both paper and textile bags.



Taped Closure (Model "DA")—it's moisture-resistant, sift-proof, tough



MODEL "DA" (portable) applies tape over "cushion stitch", making a tight seal. One operator, filling and closing, can handle 2 to 4 bags a minute . . . 6 to 12 where filled bags are delivered to BAGPAKER conveyor. Sewing operation starts and stops automatically—no tape wasted.

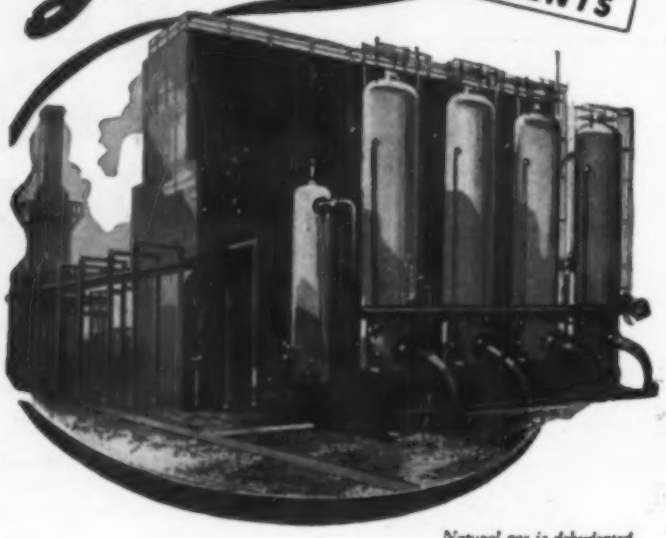
BAGPAK DIVISION

INTERNATIONAL PAPER COMPANY, Bagpak Division • 220 East 42nd Street, New York 17

Branch Offices: Atlanta, Baltimore, Boston, Chicago, Cleveland, Baxter Springs, Kans., Los Angeles, New Orleans, Philadelphia, Pittsburgh, St. Louis, Syracuse.
In Canada: Continental Paper Products, Ltd., Montreal, Ottawa.

Floridin

ADSORBENTS



Natural gas is dehydrated by use of a Floridin product in this modern plant of an important company operating in the Southwest.

The Good Earth

Florida Fullers Earth
Activated Bauxite

acts many parts

Adsorbent	Filter Aid	Drying Agent
Bleaching Agent	Catalyst	Filler
Colloidal Gel	Catalyst Carrier	Suspension Builder
Flocculant	Catalyst Binder	

in many uses

Oil Refining	Pipe Line Drying
Desulfurization	Polymerization
Dehydrogenation	Treatment of Waste
Solvent Reclamation	Selective Catalysis

Water Treatment
Formulation of Insecticides and Fungicides

Ask for Floridin bulletins.....
File them for ready reference

FLORIDIN COMPANY
ADSORBENTS
Department A, 220 Liberty St. Warren, Pa.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160

developed by Winthrop-Stearns Inc., pharmaceutical manufacturer.

pHisoderm with chlophane (G-11) is currently undergoing comprehensive bacteriological and clinical testing in a large group of hospitals, including those of the Veterans Administration and also maternity hospitals. So far reports have been described as "ranging from good to enthusiastic." Meanwhile, pHisoderm without G-11 is being increasingly used as a cleansing agent for those suffering from contact dermatitis or other skin irritations due to soap.

55. Resin for Coatings

FOR FAST-DRYING enamels, a new synthetic resin has been developed by the Coating Resins Department of American Cyanamid Co. This resin is the result of extensive research on chemical copolymers of styrene and alkyds. It will be marketed under the trademark of Cycopol.

The resin is especially adapted for use in industrial finishes and in fast-drying household enamels. Outstanding qualities of the Cycopol resin, in addition to its fast drying, are pale color, excellent toughness and adhesion to metal surfaces, a high degree of durability, high gloss and good color retention. Enamels made with Cycopol resin may be brushed or sprayed. Cycopol resin will find widespread use in high-grade enamels for household and industrial purposes, as well as for machinery and farm implements.

56. Magnetic Ferrites

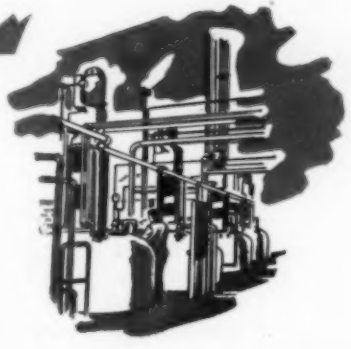
PATENTS have been granted to the Philips Laboratories, Inc., of Irvington-on-Hudson, N. Y., on two new magnetic ferrite materials. These materials have unusual properties which permit a reduction in the physical size of electrical components such as inductors and transformers. These magnetic materials were developed in the laboratories of the Philips Co. in the Netherlands, and will be manufactured and marketed in this country by North American Philips Co., Inc., under the trademark Ferroxcube.

These magnetic ferrites consist essentially of homogeneous mixed crystals of metallic oxide and iron oxide. They have big magnetic permeabilities and

Guard Against

PRODUCT CONTAMINATION

WITH ELECTRUNITE STAINLESS STEEL TUBING AND PIPE



Before specifying tubing for new equipment that comes in contact with delicate, easily contaminated chemical products, consider the many cost-saving advantages of ELECTRUNITE Tubing and Pipe—made of Republic ENDURO Stainless Steel.

For more than 25 years, ENDURO Stainless Steel has proved itself inherently clean, sanitary and easy to keep clean. It resists corrosion . . . does not contaminate metallically . . . is strong and long lasting because it is *solid* stainless steel throughout.

Add the fabricating economies of all tubing made by the ELECTRUNITE Process of electric resistance welding—*uniform wall thickness, diameter and concentricity*—and you will see why it pays *always* to specify ELECTRUNITE Stainless Steel Tubing and Pipe.

For further information—including sizes, gauges, finishes and analyses—write *today* to:

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REPUBLIC STEEL
ELECTRUNITE
STAINLESS STEEL TUBING

CHECK THESE

10 POINTS

BEFORE YOU BUY A

LEAK DETECTOR

1. **VERSATILITY:** Pressure or vacuum systems tested with equal ease, rapidly and accurately.
2. **EASE OF MAINTENANCE:** All electrical chassis are accessible, front and rear, without removal and during operation. Vacuum-system construction minimizes need for servicing.
3. **COMPACTNESS:** Well-designed cabinet has over-all dimensions 22" x 25" x 43" and is mounted on rubber-tired ball-bearing casters for portability.
4. **A-C AMPLIFIER:** Modulated ion beam allows use of indirectly coupled amplifier, thus eliminating the usual d-c amplifier troubles such as zero drift, instability, etc.
5. **AUDIO-ALARM SYSTEM:** Permits remote operation. Variable pitch of the alarm is proportional to the size of the leak.
6. **NO WATER--NO BATTERIES:** Only external connection is to a standard 115-v 60-cycle a-c line.
7. **QUICK STARTING:** Polished stainless-steel vacuum system with large passages shortens pumpdown time to 30 min. from a cold start.
8. **ONE-PIECE, RUGGED VACUUM SYSTEM:** Shock-resistant manifold machined from a solid block of stainless steel. External components assembled to block with standard O-ring gaskets.
9. **ONE COLD TRAP:** Centrally located. Traps condensables from sample and back flow from diffusion pump. Minimizes consumption of refrigerant, either liquid nitrogen or dry ice.
10. **QUALITY ENGINEERING AND DESIGN:** Manufactured by the leader in the field of mass spectrometry, built and tested to the same rigid standards as the Consolidated Mass Spectrometers; the Consolidated Leak Detector offers all of the above features PLUS all of the features of competitive instruments . . .

Factual proof that a

CONSOLIDATED LEAK DETECTOR

is the best that money can buy

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CONSOLIDATED ENGINEERING CORPORATION

Analytical Instruments for Science and Industry

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low remanence and coercivity. In contrast with the usual magnetic materials, which are highly conductive, the new materials are essentially electrically insulating.

Properties of these materials make them particularly adapted for high-frequency inductance coils, radio transformers and other electromagnetic apparatus. By their use, coils having a quality coefficient many times greater than conventional coils can be produced. At the same time a substantial reduction in the volume of the coil is realized. Ferroxcube is currently being used as the 25-kv. transformer for the Protelgram projection television system in which its size is only 1¾ in. in diameter and 1⅛ in. in thickness.

57. Talc for Paint Making

DEVELOPED for use in the manufacture of paints, a talc that possesses high oil absorption and high consistency is now being distributed throughout the eastern part of the United States by Innis, Speiden & Co. of New York. Known as Sierra Fibrene C-400, the talc meets the stiff requirements of the Navy and Maritime Commission. More than 40,000 tons have been used without a single rejection.

Sierra Fibrene C-400 possesses many outstanding characteristics. Its combination of platey and acicular particles imparts extreme exterior durability. According to the manufacturer, it is continuously the whitest talc on the market. It is one of the finest ground of all commercially milled talcs. Non-abrasive and containing no over-size crystalline particles, the talc can be used on highly polished roller mills without scratching or taking on metal discoloration. It wets easily and quickly. The talc speeds up production time, grinding in one-half to one-third the time of other talcs, thus materially reducing costs. Promoting pigment dispersion, it stretches the hiding pigments to the limit, thus permitting a higher extender content and again reducing costs.

According to Innis, Speiden & Co., Fibrene C-400 is cheaper than other competitive low-priced talcs on a cost basis per gallon of finished paint. Specifications, prices and samples may be secured by writing to the manufacturer. The company stocks Sierra Fibrene C-400 in the East and in a number of its branches in the Midwest.

58. Hydraulic Fluid

A COMPLETELY non-flammable aircraft hydraulic fluid that will not ignite even in a flame at 5,000 deg. F. is now

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SOLVAY Products
for the Soap Industry

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SIER-BATH GEAREX PUMPS
—no pulse, but very much alive!

SIER-BATH GEAREX PUMPS are sturdy positive displacement units that discharge liquid without pulse or vibration. This is accomplished by means of double helical pumping rotors and discharge passages of proper area to insure continuous overlapping displacement of liquid. The rotors are not in contact, thus reducing wear and increasing life. If you are interested in pumping efficiency with low maintenance costs, write us for booklet.

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Balanced axial thrust • Vibrationless operation • Roller bushings for precision running under load.
Pumps: Oils, varnishes, solvents, molasses, chemical solutions
Capacities: 1-550 g.p.m.
Discharge: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.

● The two Sier-Bath Gearex Pumps shown are installed in the boiler house of Metakloth Company, Lodi, New Jersey. They pump Bunker C fuel oil to the boiler at a pressure of 60 lbs. The user expresses complete satisfaction with the installation which was made in December 1946.

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Sier-Bath
GEAR and PUMP CO., Inc.

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FOR MORE INFORMATION
See Reader Service Coupon on pages 159-160

being marketed by Standard Oil Co. of California. The new fluid is so resistant to fire that it is a possibility for use in fire-extinguisher systems on planes.

Modification of present hydraulic systems will be required before the new fluid, known as RPM Non-Flammable Hydraulic Fluid, can be used generally. The new product will eliminate a fire hazard that is a factor with bigger planes which use high-pressure hydraulic systems to operate landing gear, flight-control surfaces and cabin superchargers.

Two years of experimentation by California Research Corp., Standard's research organization, went into this development. In addition, aircraft manufacturers, airlines and manufacturers of hydraulic systems have made other cooperative tests. The new hydraulic fluid is a major contribution to air-travel safety.

Basic raw material for the fluid is a highly flammable petroleum gas, which is converted finally into a non-flammable liquid. In addition to complete non-flammability, which is retained even after long exposure to air, the new product retains fluidity and other necessary characteristics from 70 deg. F. below zero to 250 deg. F. above, is non-corrosive to all metals used in aircraft and lubricates at pressures exceeding 3,000 psi. It will be sold by the aviation division of California Standard's marketing department.

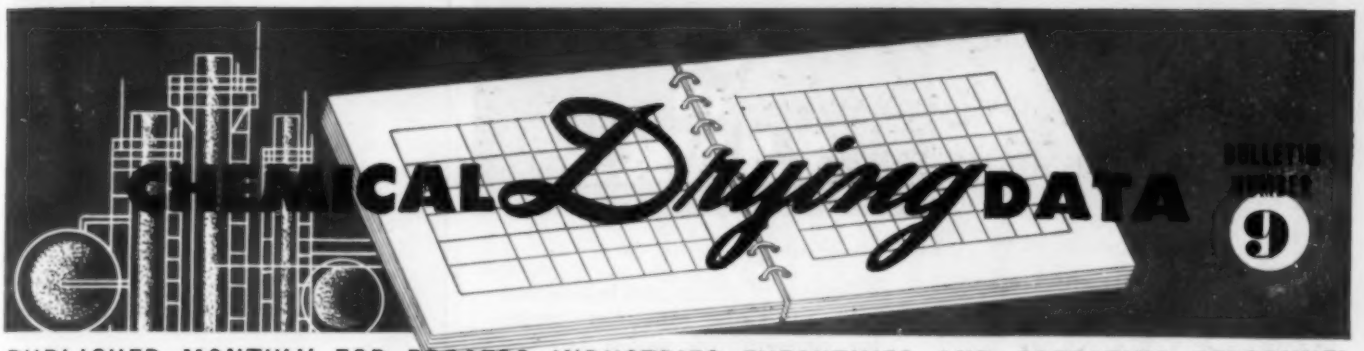
59. Toloxyn

THE NEW pharmaceutical chemical Toloxyn is now immediately available to drug manufacturers from the Sumner Chemical Co. of Zeeland, Mich.

British investigators working with the drug report that it is an "anesthetic potentiating" agent. In particular, it produces muscular relaxation under relatively light general anesthesia. It has some of the properties of curare but is without the extreme hazards. In England the drug is marketed by British Drug Houses, Ltd., under the name Myanesin.

Recent reports from U. S. researchers indicate that when the drug is orally administered in elixir form, it has valuable palliative possibilities in shaking palsy, Parkinsonism and other muscular disorders of the spastic type.

The chemical itself is properly



PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

SCHEDULED DRYING ESSENTIAL FOR UNIFORMITY IN CERAMIC PRODUCTION

When ceramic products are dried under rigidly controlled conditions, following a predetermined schedule the uniformity of the finished product is assured and spoilage greatly reduced.

In the past uneven or faulty drying often resulted in a high rate of spoilage in final firing. That was because guesswork or chance was the governing factor in the drying. Today, Proctor "job engineered" drying systems have eliminated all elements of chance, for each system is designed to meet the specific requirements of the product being dried. Exhaustive tests reveal these requirements and indicate the type and design of the drying system to suit the product requirements. In addition the drying schedule is carefully worked out and then adhered to by the plant. This assures uniform results at all times. Scheduled drying need not be limited to continuous systems—but can well be applied to batch drying, even as done in tray dryers.

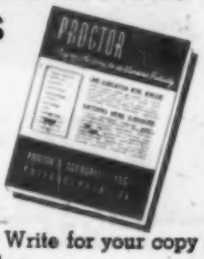
The needs of the ceramic industry range from relatively small tray dryers up to huge continuous systems and Proctor engineers have developed equipment in all of these types. Careful study reveals whether the need is for a tray dryer, automatic mangle, periodic truck dryer or progressive tunnel system and recommendations are made only on the basis of fact. In addition to designing and building conventional drying equipment for this industry, Proctor engineers have done considerable experimental work with infra red drying. Many factors enter into determining when this is advisable and the data that Proctor engineers have accumulated is extremely helpful as they consider this as a possibility.

This work in the ceramic field represents one more phase of the chemical process industries where Proctor engineers have been able to substitute certainty for guesswork, and profit for loss. If you are considering a ceramic—or any chemical drying problem—you will find it pays to enlist Proctor engineering skill early.

drying systems for:

Crucibles
Insulators
Spark Plugs
Dinner Ware
Sanitary Ware
Glass
Glass Pots
Molded Insulation
Saggers
Tile
Hollow Brick
Refractory Brick
Pressed Porcelain
Other ceramic products

NEW BULLETIN EXPLAINS PROCTOR DRYING SYSTEMS FOR CERAMICS



This four page bulletin, just off the press, elaborates in more detail on Proctor equipment for the ceramic industry. It is interesting and informative. Write for your copy of Bulletin No. 334 today.

Much Proctor drying equipment and textile machinery is covered in full or in part by patents or patents pending.

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Write for latest Cole catalog — "TANK TALK"

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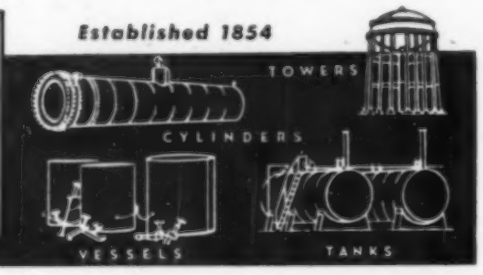

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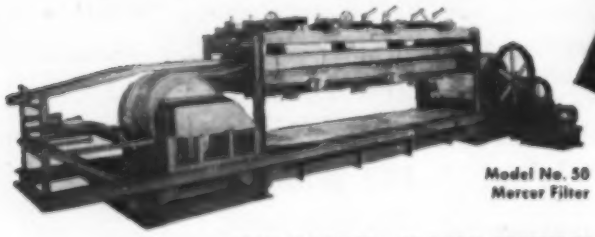
Low-cost Efficient Continuous Suction Process



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PERFORMANCE—PROVEN FEATURES
Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

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Arrange for Test
Mercer plant is equipped to conduct and report upon experimental tests made with samples of your materials. Inquire about this service.

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named 3-(o-toloxy)-1, 2-propanediol according to the Geneva system of nomenclature. It has also been called α, β-dihydroxy-γ-(2-methylphenoxy)-propane as well as α-glyceryl-o-cresyl ether. As a generic substitute for these chemical terms, the name Toloxyn has been suggested.

Sumner offers Toloxyn only in bulk to pharmaceutical manufacturers for manufacturing use. Since the drug has not yet been cleared by the Food and Drug Administration for general distribution, its present use is limited to clinical investigation and research.

60. Flame- and Heat-Resistant Plastic

Celanese Corp. of America has developed a new thermoplastic material that resists both flame and heat. The new material is a cellulose acetate plastic.

Called Lumarith XF, this new material bridges the gap between the thermoplastic and thermosetting plastics by combining the flame and heat resistance of the latter with the easy moldability and color range of the former. It has been approved by the Underwriters' Laboratories for such applications as lightning arresters, electric mixers, vacuum cleaners and switch housings.

The new Celanese plastic will appear in time for the Christmas trade and will be used in toys and items such as tree lights and electric shavers. Its use is also indicated for safety respirators and equipment, and it will become an important material for safety goggles.

61. Plasticizer Oil

The Chemical Products Department of the Socony-Vacuum Oil Co., Inc., has developed a highly efficient plasticizing oil for many compounds of natural rubber, Neoprene and GR-S. This is called S/V Sovaloid A Special.

The new petroleum product, which has a bright, clear, amber color, is more resistant to discoloration than any other general-duty plasticizer now in use in the rubber industry. It produces tight, snappy vulcanizates with excellent aging qualities.

In addition, S/V Sovaloid A Special has no effect on cure, imparts excellent aging properties to various rubber compounds and provides good dispersion of the fillers which are used in rubber compounding.

Extensive testing in Socony-Vacuum's Technical Service Laboratories shows that comparatively large quantities of S/V Sovaloid A Special can be absorbed by Neoprene before the

4-CYCLE GAS-ENGINE COMPRESSORS

Six 800-hp Type KVG gas-engine-driven compressors on recycling service.

4-Cycle **DEPENDABILITY**
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FORGED STEEL FITTINGS

Costly shutdowns are prevented by using Ladish fittings because forging under rigid laboratory controls improves physical properties four ways:

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Ample stocks . . . complete line . . . size range ⅛ through 4 inches . . . 2000 through 6000 pound ratings . . . Carbon, Alloy and Stainless steels.

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See Reader Service
Coupon on pages 159-160

saturation stage is reached or before surface blooming becomes apparent, permitting the manufacture of unusually soft products.

The new plasticizing oil has a comparatively low viscosity and flows freely at below-zero temperatures. It is now being produced in the Socony-Vacuum refinery at Paulsboro, N. J., and it is available in reasonable volume.

62. Ethylhexoic Acid

THE FIRST tank car of ethylhexoic acid ever shipped recently moved from the South Charleston, W. Va., plant of Carbide & Carbon Chemicals Corp. This shipment reflects the growing importance of metallic salts of ethylhexoic acid as high quality paint driers. New sources of raw materials have enabled Carbide to expand the production of ethylhexoic acid and to offer it at the new low price of 29c. a lb. in tank car quantities.

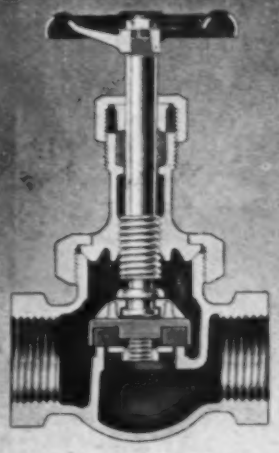
To the manufacturer of paint driers the fact that ethylhexoic acid is of constant purity is of great importance in eliminating processing variables. In addition, its excellent color and freedom from disagreeable odor as compared with the naphthenic acids permits its use in specialty paints where the naphthenate driers are not entirely suitable. The acid number of ethylhexoic acid is approximately 370 compared to 230 for the standard grades of naphthenic acid. This high acid number permits the introduction of the desired metal content into paint formulations with a minimum of solubilizing acid remaining in the dried film. As a result, coatings containing an equal metal content are of superior quality if an ethylhexoic acid salt is used.

Ethylhexoic acid has been used as an intermediate in the preparation of such plasticizers as triglycol dioctate. In addition, ethylhexoic acid has recently become of interest as a modifier for alkyd resins where its introduction into the phthalic anhydride-glycerine chain produces a film having improved flexibility. The aluminum salt of ethylhexoic acid has been found to have remarkable properties as a gelling agent for hydrocarbons, and it should find extensive applications in the preparation of greases, the thickening of lacquers and in other applications where gelling of hydrocarbons is desired.

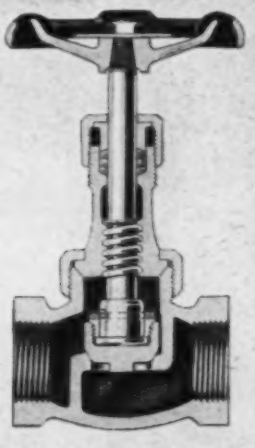
R-P&C VALVES

for low-cost flow control

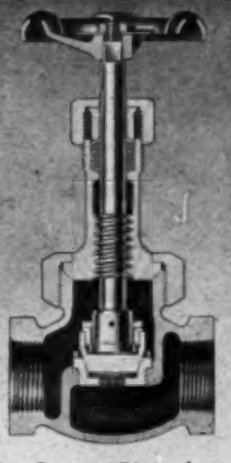
Here are a few of the more popular numbers in Reading-Pratt & Cady's **BRONZE** ***line***



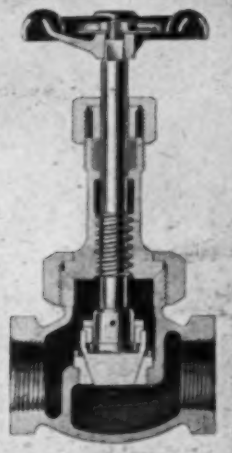
Union Bonnet Globe (or angle). With renewable, interchangeable discs for general services.



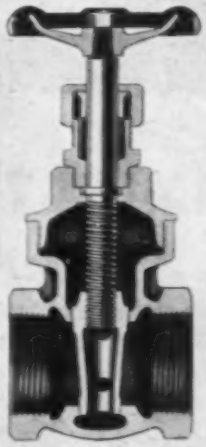
Union Bonnet Globe (or angle). Discs may be reground without removing valve from line. For occasional throttling.



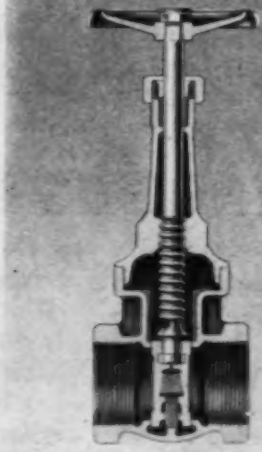
Union Bonnet Globe (or angle). Semi-plug type for frequent throttling service. Renewable copper nickel alloy disc and seat ring.



Union Bonnet Globe (or angle). Full plug type for severe throttling service. Renewable copper nickel alloy disc and seat ring.

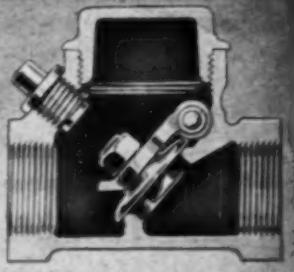


Stationary Stem Gate. Solid wedge renewable. Wedge can be reversed if one side becomes worn.



Rising Stem Gate with double disc. Disc easily assembled or taken apart—yet cannot work out of place.

SHOWN HERE are some of the numbers in the R-P&C line of high quality bronze valves. R-P&C also make iron and steel globe, angle, gate and check valves—iron cocks and Lubrotite gate valves—Bar Stock valves of bronze, carbon steel and alloy steels—cast steel fittings. Get in touch with your Reading-Pratt & Cady Distributor.



Swing Check Valve. Has renewable disc, regrinding seat. Disc free to rotate, thus distributes wear uniformly.

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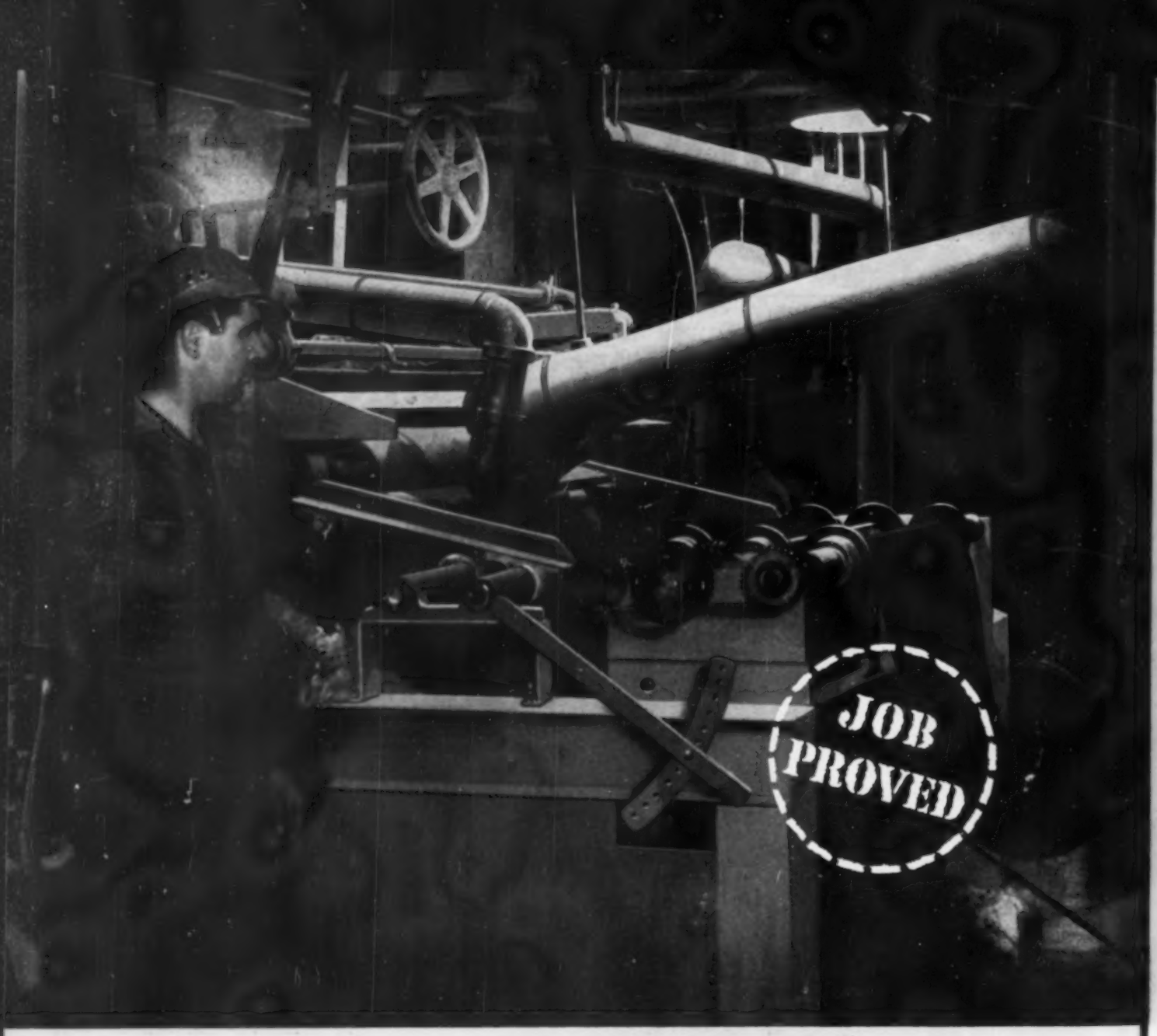

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Production lagged in an asphalt plant. The two 2,000-gallon heat-transfer absorbers were losing efficiency because of an unstable circulating oil. At high temperatures it broke down and formed deposits which insulated the walls of jackets and pipes, retarding heat flow. Frequent oil changes, with 3-day shutdowns, would have been necessary to maintain efficiency.

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Roger Williams, Jr., ASSISTANT EDITOR

Contract-signing like this* when backed up with sound employee relations, can set a . .

Labor Peace Record

National Planning Association is investigating why certain companies have excellent labor relations, few strikes. Here is what they found at Dewey and Almy.

Joseph M. Gambatese

Washington Labor Editor, McGraw-Hill Publishing Co.

MUCH has been written about strikes and their causes. And if you are one who feels he has had more than his share of labor trouble, you probably have asked:

"What can I, part of business management, do to help make labor peace in my plant?"

In asking this question, of course, certain premises are implied. The business must continue to serve its economic purpose: produce and sell chemicals at a profit. It must maintain, if not improve, its competitive position. It must grow; produce more and better goods at lower cost. It must move ahead in scientific research. And management must continue to manage.

Assuming all these, how can you contribute to labor peace in your plant?

There is no single or positive answer. But an attempt to find answers is being made by the National Planning Association in Washington. It is trying to find them by examining what goes on between labor and management where they do get along well.

In the middle of 1947, this nonprofit, nonpolitical organization of men from business, labor, government, agriculture and the professions appointed a committee of 29 labor relations experts. This committee's job is to find the "Causes of Industrial Peace Under Collective Bargaining." From thousands of nominations, the committee selected for study 15 plants where healthful union-management relations exist. The findings are being published monthly and are available at $1 each or $12.50 for the full set when completed. John Hay Whitney's Greenwood Foundation is supplying $60,000 for research costs.

NPA turned to the chemical industry for its third study: the main plants of Dewey and Almy Chemical Co. at Cambridge, Mass. The first two were on (1) Crown Zellerbach Corp. and the Pacific Coast Pulp and Paper Industry and two AFL unions and (2) Libbey-Owens-Ford Glass Co. and a C.I.O. union.

The analysis of Dewey and Almy's relations with the A.F.L. Chemical Workers Union was prepared for NPA by Douglas McGregor and Joseph N. Scanlon, former CIO leader, both on the faculty of the Industrial Relations Section of Massachusetts Institute of Technology.

It discusses in considerable detail the transition from the paternalism of top management before the union came on the scene in 1939 to the stable union-management situation that exists today. It tells of management's changing attitude toward the union, the effect of the union relationship on the company's competitive position, worker productivity and other factors which cannot be covered in this space. For full details you should obtain a copy of the committee's study.

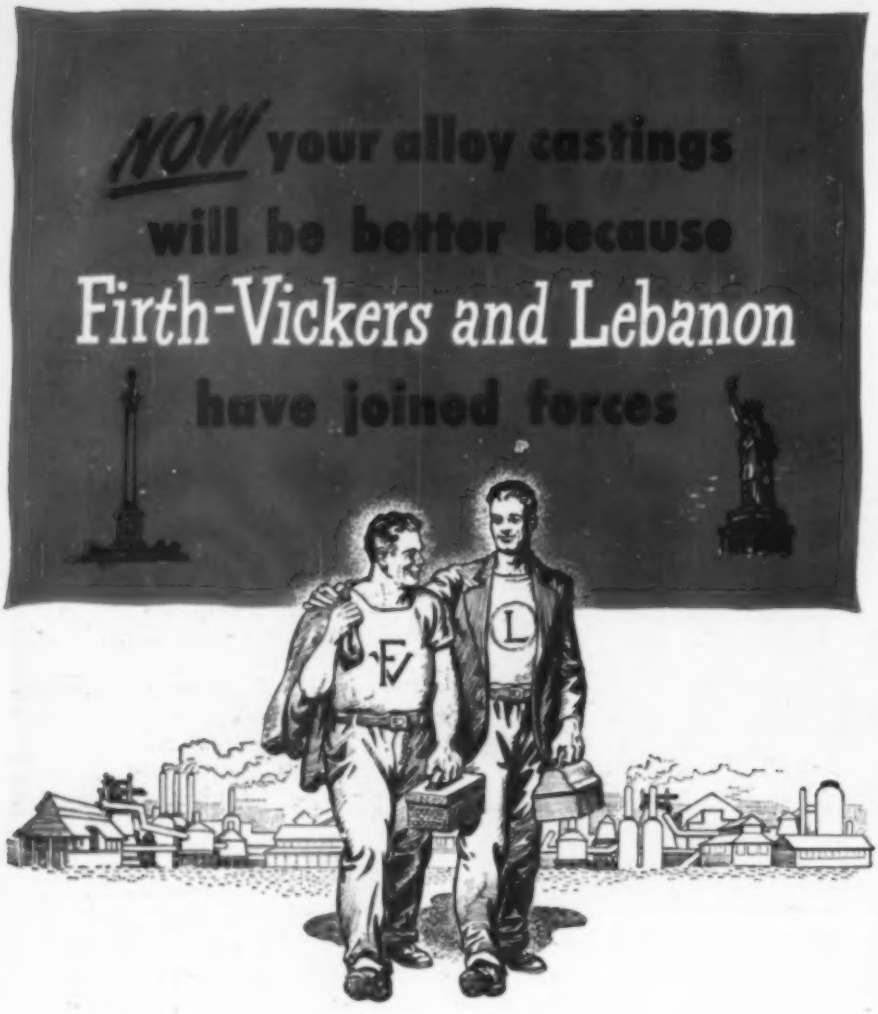
We will look closely, however, at one section of the Dewey and Almy report which may give you some clues to what you might do to bring labor peace to your plant. Or, if your union relations are satisfactory, you may want to check your policies and practices against these. It is a section of the NPA study entitled: "Management Actions Contributing to the Health of the (Union) Relationship."

What contribution does Dewey and Almy make?

The study lists a number of company policies, procedures and practices, the underlying theme being frequent consultation and fluid communication both upward and downward on the management side, and a large amount of joint action and cooperation with the union.

McGregor and Scanlon describe this as "consultative supervision." For example, all problems of worker-management relations, from reports on

* At the table (l. to r.) Ernest Robertson, president of Local 86, International Chemical Workers Union, AFL; Bradley Dewey, president of Dewey and Almy Chemical Co.; E. J. O'Brien, international union representative. Union and company men look on.



Corrosion and heat-resistant alloy steel castings of certain types acquire better characteristics when made by the Centri-die process in permanent molds. This method was developed by Firth-Vickers of Sheffield, England, over a long period of experimentation. It is largely responsible for the superior qualities of the Rolls-Royce, De Havilland, Bristol and other British airplane jet engines. Since the war it has been widely applied to castings for corrosion and heat-resistant service.

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unusual grievances to major company policy, are discussed and decided at management policy meetings. These have been held weekly since 1943. The company's vice president and general manager presides. Around him sit the general superintendent and the chief engineer with their respective subordinates down to, but not including, foremen.

All levels of management participate—the foreman through his superintendent, who expresses the foreman's viewpoint at the policy meetings and later reports what went on, or was decided, at a foremen's meeting (the same day).

Important policy decisions are distributed to all members of management and to union officials in a policy manual.

These decisions are not considered unilateral because issues affecting the union are discussed and argued out with union officials in a separate meeting. In this way the union participates in resolving problems and determining policy as much as does middle and lower management.

Besides the weekly management policy meetings, there are weekly meetings of the personnel director with the union's executive board to take up any problems of mutual interest. No decisions are made at these meetings, but many problems are explored. Any issue of importance is put on the agenda of management's next policy meeting or referred to the appropriate management representative for further discussion with the union.

Policy Manual

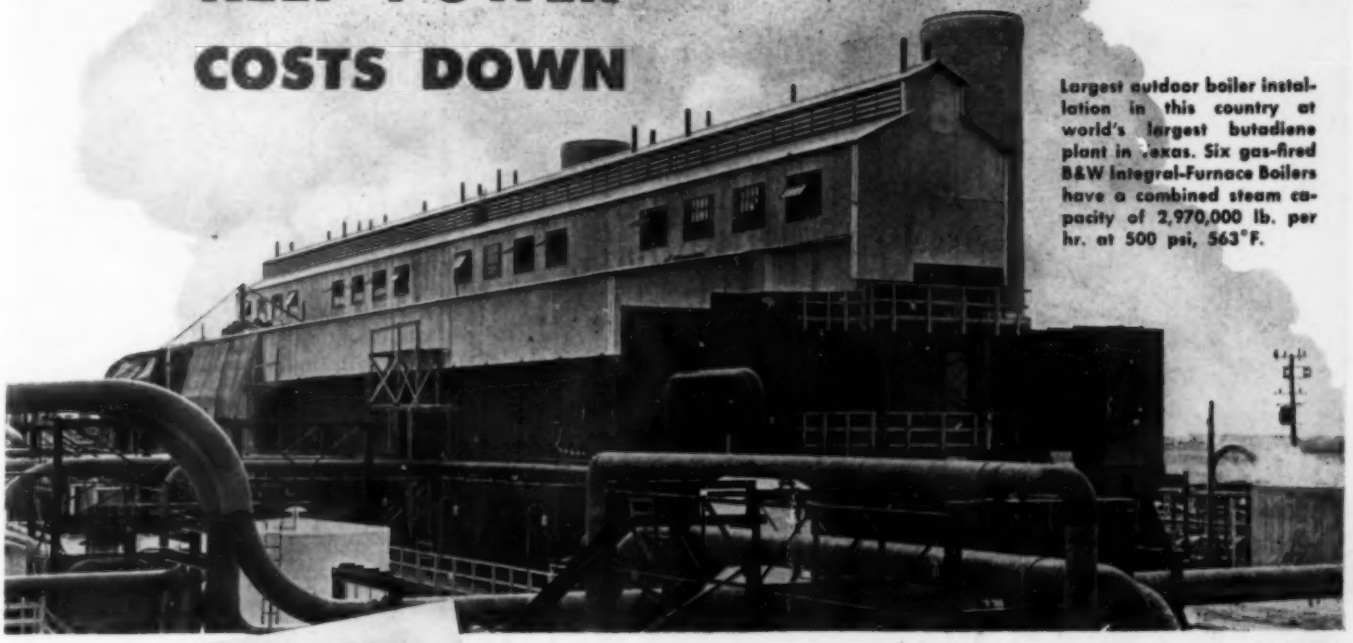
All policy and contract interpretations, working rules, procedures and other related information is contained in a loose-leaf policy manual edited and distributed by the personnel department. Except for pages relating exclusively to management instructions, these policies are distributed to union officials and management alike.

The NPA study emphasizes that these are issued *after* full discussion and thus are not regarded by the union as matters of management fiat.

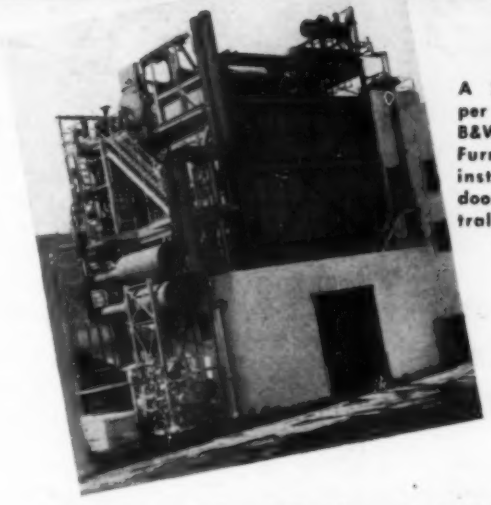
There is danger of arbitrary action, unexpected changes and friction unless management policies are reduced to writing and are known to all on both sides, the report states. For this reason, Dewey and Almy began a series of meetings of line management personnel (except foremen) in 1941 to formulate personnel policies and reduce them to writing. But before they were adopted, they were discussed with the union, resulting in some revisions.

Some policies were worked out

OUTDOOR BOILERS . . . KEEP POWER COSTS DOWN



Largest outdoor boiler installation in this country at world's largest butadiene plant in Texas. Six gas-fired B&W Integral-Furnace Boilers have a combined steam capacity of 2,970,000 lb. per hr. at 500 psi, 563°F.



A 200,000 lb. per hr. oil-fired B&W Integral-Furnace Boiler installed outdoors at a central station in Florida.

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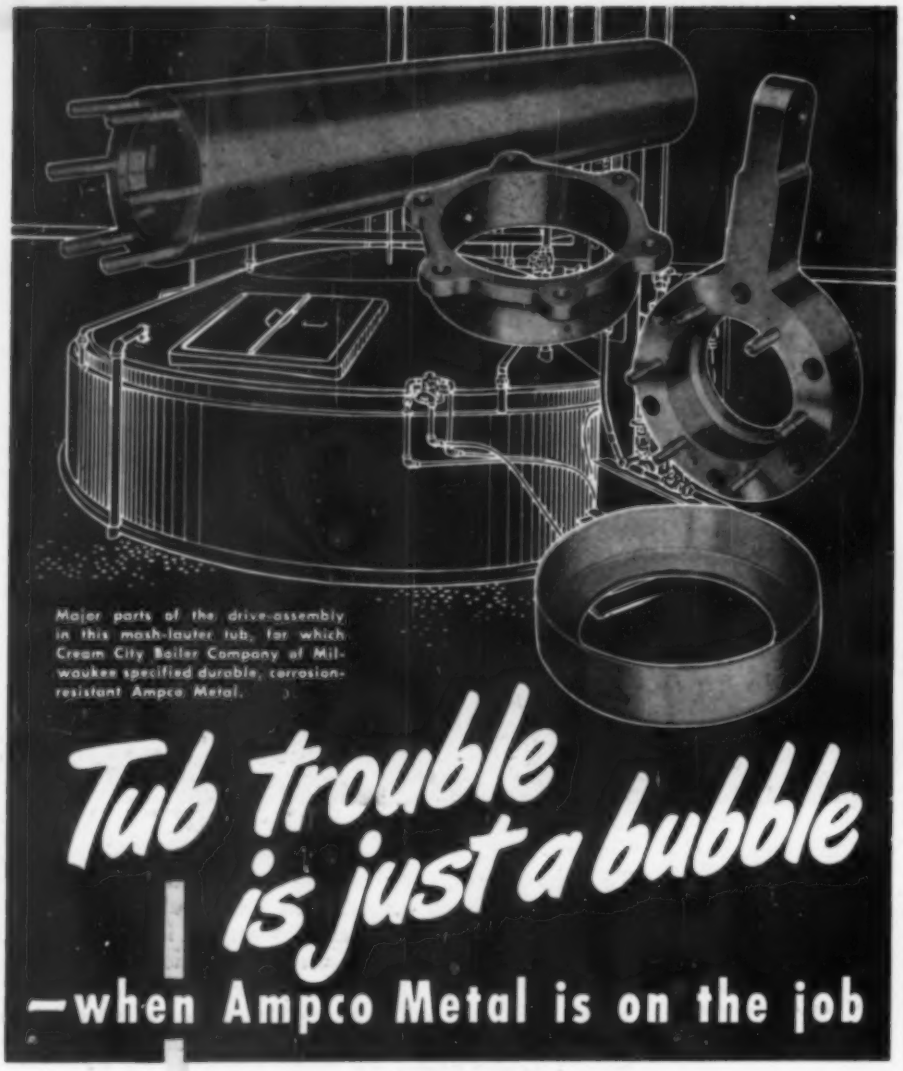
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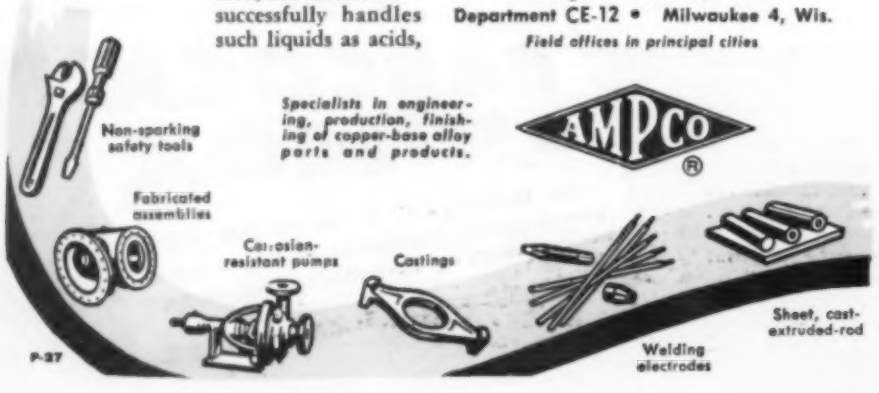

jointly from the beginning. For instance, disciplinary policy. A union-management committee worked for months to arrive at a satisfactory set of disciplinary rules and penalties. They came up with fixed penalties for only two types of infractions: drinking on the job and smoking. (The union agreement also provides for a five-day "cooling-off" period in cases of penalty layoff or discharge. During the five days, the employee is under suspension and the union can discuss the case with management. This sometimes avoids difficult "face-saving" problems.)

The union contract is printed after each renegotiation and distributed to all employees. In 1945, the union's constitution and bylaws and the agreement were printed in one booklet at the request of the union, with the union paying half the cost.

Union Participation

Through the various meetings and publication of policies, the management practices "consultative supervision" within its own ranks, McGregor and Scanlon point out. In addition, the union is given a chance to participate before final decisions are made.

"This participation is important to the health of the relationship," the report states. "Even though many of the problems handled in this way lie outside of the union agreement and are not actually matters for collective bargaining, the fact that the union is consulted is one measure of management's acceptance of the union."

Much use is made of special committees—joint, management or union—to consider administrative or policy problems. Some, like the joint committee on job evaluation, are permanent groups. This committee hears all matters affecting job rates—changes in job content, new jobs, requests by workers or management for re-evaluation of a job and the like.

A committee of superintendents meets after each holiday to consider exceptions to the contract rule that, unless an employee is ill, he must work the day before and the day after a paid holiday in order to receive pay for the holiday. Exceptions are considered when recommended by the foreman or requested by the employee. This procedure, according to the report, "helps to create the flexibility and human consideration essential to healthy relations without destroying the purpose of the negotiated rule."

There is also a standing union committee to which the company gives data on all proposed promotions before they are finally announced: who bid for the job, whom management

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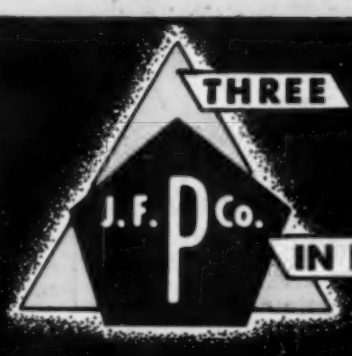

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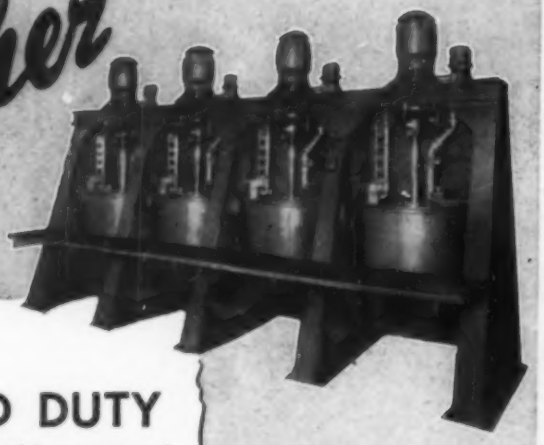

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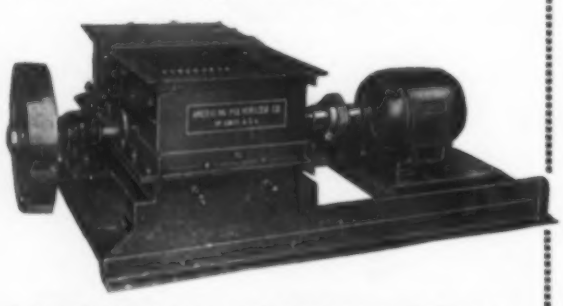

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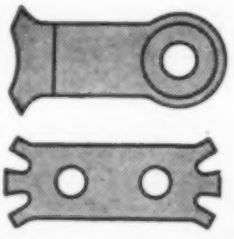
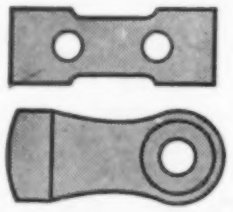


Chisel point, shredder type, for fibrous materials.



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plans to appoint, and why. If the committee feels the proposed promotion is unfair, it may discuss the matter with a management representative before the final decision is made.

The company believes in interim negotiation, before a contract expires, to remedy any unworkable or unreasonable provisions in the contract if it can be done without giving an unfair advantage or concession to either side. In 1944, a clause was inserted in the contract providing that no employees would be transferred between two of the Cambridge plants prior to 1949.

In 1947, a major layoff occurred in one of the plants. Shortly thereafter, a number of jobs opened in the other plant when the state withdrew permission previously granted to use women on third shift operations. The union asked the management to reconsider the contract with the view to hiring some of the employees laid off from the other plant. The company agreed it would if the union considered some modification of the layoff rules. The union agreed. The modification was being negotiated when the report was written. McGregor and Scanlon expected it would result in a "mutually satisfactory solution."

The management and union have also worked together to reduce the number of grievances and to settle more at the earlier steps of the grievance machinery.

Welfare History

Dewey and Almy's concern for the welfare of its employees since its founding almost 30 years ago is cited in the report as one of the management's contributions to the healthful union relationship. It has aided individual employees in legal or financial difficulties or in need of special medical or surgical care. And it has instigated such policies as sickness and accident insurance and a pension plan.

Says the report: "Members of management who have not demonstrated this kind of humanitarian interest in employees, or who have—through malice or stupidity—been unfair or discriminatory in their actions, have been transferred outside the line organization. In certain extreme instances they have been forced to resign."

This attitude extends to technological changes which involve displacement of workers. A few years ago a division of the company employing 76 persons was moved from Cambridge to a new plant in another area in order to locate the operation near the source of the raw materials.

For six months prior to the move the problem of placing the affected employees was studied. Some were transferred to other jobs as openings

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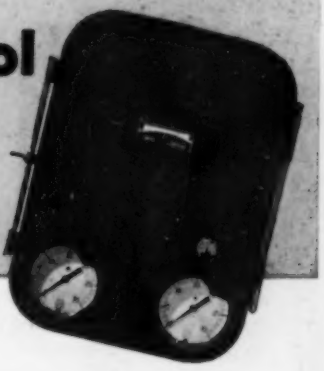

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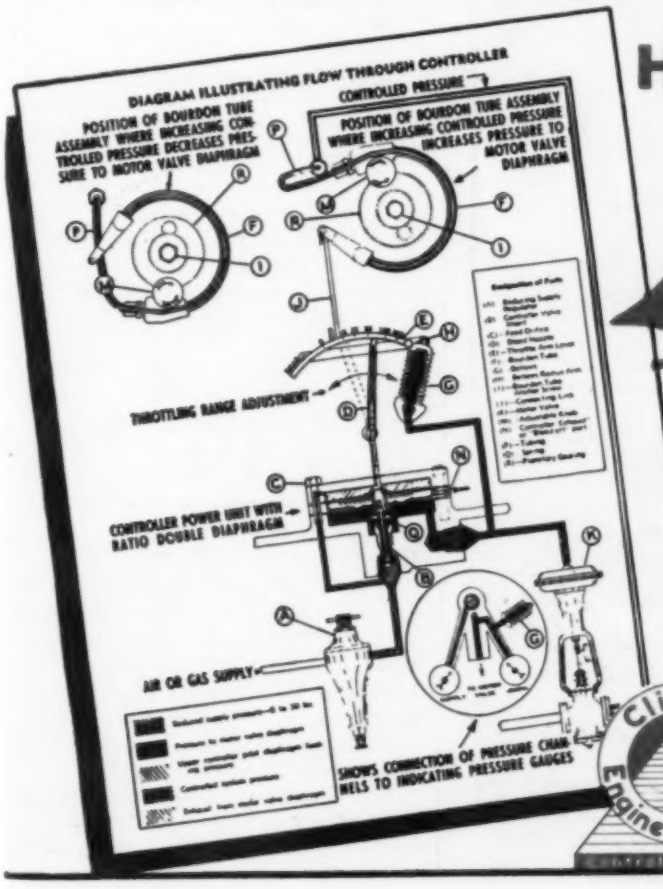
DIAGRAM ILLUSTRATING FLOW THROUGH CONTROLLER
CONTROLLED PRESSURE
POSITION OF BOURDON TUBE ASSEMBLY WHERE INCREASING CONTROLLED PRESSURE DECREASES PRESSURE TO MOTOR VALVE DIAPHRAGM
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occurred. However, a crew of 35 was needed up to the last moment to build up inventory to supply customers during the transfer. In the end, none of the employees were laid off, although 10 resigned.

By this time, you are probably wondering whether Dewey and Almy's "consultative supervision" doesn't encourage the union to insist on bargaining over matters which are management perogatives. This is always a danger, and some members of Dewey and Almy management have feared just that. But McGregor and Scanlon insist in the study that "there has been relatively little difficulty along these lines."

"The union has come to expect that it will be consulted before major policy decisions are reached and before procedures are changed," the report explains. "However, it respects management's right to make changes lying outside the collective agreement, and there is rarely any difficulty even when the final decision is contrary to the suggestions offered by the union."

The report cites the time the company decided to change the time of day that pay checks were given out. The reasons were discussed with union officials. They objected. But management felt that the changes were justified and would not cause unreasonable hardship on anyone. After several meetings with the union officials, it notified them that it would proceed with the change on a certain date. The union accepted the decision.

Management Contribution

On this subject of management's contribution, the NPA report concludes that Dewey and Almy's policies and practices are not in themselves particularly unusual and are followed by other "progressive" companies.

But there are (the report says) two important points in connection with the policies:

1. The spirit which underlies them, and
2. The fact that they are not regarded as panaceas which will in themselves create a healthy relationship.

"They (the policies) are the result of, rather than a substitute for, a friendly attitude toward the union and a sincere desire to live successfully under collective bargaining," the study sums up. "It is not nearly so much what management has done as how it has done it which provides the key to the health of the relationship."

In other words, the causes of labor peace are a lot of things which, added together, reflect a wholesome attitude by both sides. That sounds like a big order, but it isn't. Because most companies *have* labor peace.

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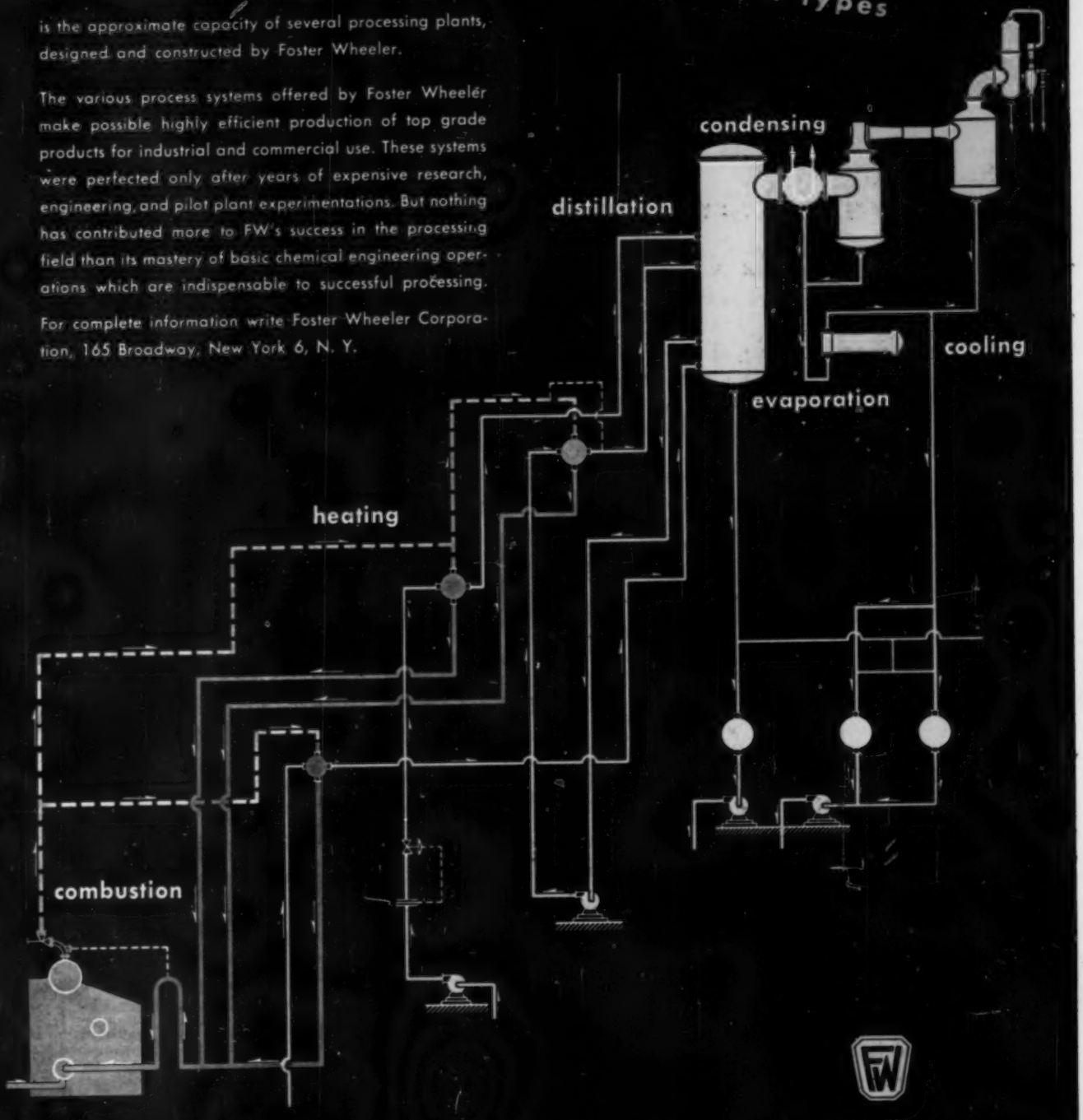

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CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

RAW MATERIAL, phosphate rock, is moved by electric drag line and diesel trucks to the plant for charging furnaces.

PRODUCT, phosphorus, burns in air. It is handled and shipped under a water blanket. Here a tank car is checked.

Phosphorus Output Boosted By Monsanto Expansion

A FIFTH electric furnace for the production of elemental phosphorus was dedicated at Monsanto, Tenn., by Monsanto Chemical Co., in October. Full production is expected to be achieved January 1.

The plant was host to a group of visiting newsmen and company officials from St. Louis and Anniston, Ala. Dr. Charles A. Thomas, executive vice president of the company, R. R. Cole, vice president and member of the executive committee, John L. Christian, acting general manager of the phosphate division, R. S. Weatherly, general sales manager of the phosphate division, H. F. Weaver, production manager, Dr. R. L. Jenkins, research director, W. T. Durrett, Ralph Alexander of the division's engineering department and others were company guests. They were greeted by Edward J. Bock, new plant manager.

Dr. Thomas brought out the fact that the company had steadily retained the top position in the field achieved in 1937 through a successful pioneer effort to produce yellow phosphorus on a large commercial scale in an electric arc furnace. With the addition of the new furnace, he said, output of the plant will be increased nearly 50 percent. This will further strengthen Monsanto's position as the world's largest commercial producer of yellow phosphorus. He emphasized the fact, however, that because of the annual curtailment of TVA power, there would be no increase in production until early 1949.

Operation here consists of mining and processing the phosphate rock into yellow phosphorus. Phosphate-bearing earth is strip-mined near the plant, washed, sintered and processed electrically to produce yellow phosphorus which is better than 99.9 percent pure.

Plans for the construction of a washing unit to eliminate fluorine gas present in smoke emitted from the Monsanto phosphorus plant were revealed at the dedication of the new furnaces. A contract for construction of the unit's scrubbing towers has been signed with the Rust Engineering Co. Gases from the sintering plant will be scrubbed with a liquid spray which absorb fluorine. Another process will then neutralize the fluorine in the resulting liquid. Mr. Bock stated that the scrubbing process is the result of several years of research and study. The installation of the unit is expected to eliminate any possible contribution on the part of Monsanto to the presence of fluorosis in the area.

Standard Starts Construction On Baton Rouge Headquarters

ESSO STANDARD OIL CO. has begun at its refinery at Baton Rouge the construction of a $3 million, six-story main office building and adjacent cafeteria. A 130-ft. covered walkway will connect the two buildings, which should be completed in about 17 months.

The completely air conditioned office is a steel and brick structure featuring movable steel partitions, acoustic treatment and mechanical services designed to permit rearrangement of offices without making structural changes. A conference room with a seating capacity of 100 is on the sixth floor.

John W. Harris Associates, New York, is constructing the building, for which Lathrop Douglas is the architect. Carson & Lundin, New York, is associate architect. Bodman and Murrell, Baton Rouge, is architect for

Coal gasification is studied at Pittsburgh Consolidated Coal's pilot plant in Library, Pa. Operation started last month.

the concrete and masonry cafeteria, which John W. Harris Associates is also erecting.

Attendance Records Broken At AICHE New York Meeting

RECORD breaking crowds of more than 2,300 chemical engineers filled the technical sessions at the annual meeting of the American Institute of Chemical Engineers in New York last month. The meeting was split into twelve sessions and included symposiums on bubble-plate efficiencies, instrumentation, drying and chemical plant location.

Francis J. Curtis, vice president and secretary of the executive committee of the Monsanto Chemical Co., St. Louis, Mo., was elected president of the institute. Serving with Mr. Curtis in the office of vice president will be Warren Lee McCabe, former head of the chemical engineering department at Carnegie Institute of Technology, and now director of research of the Flintkote Corp.

The chemical engineers elected as directors were: H. D. Wilde, manager of the technical and research division, Humble Oil and Refining Co., Houston, Tex.; Paul D. V. Manning, director of research of the International Mineral and Chemical Corp., New York, N. Y.; and Irvin L. Murray, assistant superintendent of engineering of Carbide and Carbon Chemicals Corp., South Charleston, W. Va.

At the meeting, the Professional Progress Award in Chemical Engineering was made to A. P. Colburn, assistant to the president, University of Delaware. Following the final technical sessions on November 10, the Ninth Award for Chemical Engineering Achievement was made at a banquet in the Starlight Roof of the Waldorf-Astoria. This award, sponsored by *Chemical Engineering*, was presented to the Shell Development Co. (see page 108).

ACS Regional Meeting Held at Shreveport

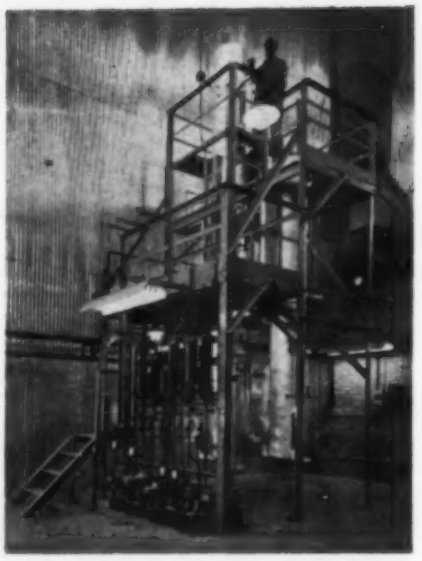
A HIGHLIGHT of the fourth Southwest regional meeting of the American Chemical Society in Shreveport December 9-11 was the presentation of the first Southwest Regional Award. Dr. Eugene P. Schoch, professor of chemical engineering and director of the bureau of industrial chemistry at the University of Texas, was the recipient of the award which consists of a bronze plaque and $200. The award is to be presented each year for significant achievement in the chemical profession.

During the three-day convention the program was scheduled to include a number of tours of industrial plants, including those of International Paper Co. at Springhill, La.; Lion Oil Co. and Root Petroleum Co. at El Dorado, Ark.; J. B. Beaird Co. at Shreveport; Libbey-Owens-Ford Glass Co. at Shreveport; and the United Gas Pipe Line Co. gasoline plant at Carthage, Tex.

The technical program embraced a schedule of nearly 100 addresses. Reflecting the importance of petroleum chemistry and engineering in the Southwest, 20 papers were devoted to this subject. The training of chemists in various subjects also received emphasis from about 25 speakers. A number of addresses touched upon the education for and practice of chemurgy with particular reference to cotton and cottonseed.

Diamond Opens New Alkali Plant at Houston

DIAMOND ALKALI Co. dedicated its new $14.5 million caustic-chlorine plant near Houston this month with a day-long celebration on Nov. 15. Events opened with a buffet breakfast at the Ben Milam hotel in Houston, followed by presentations of technical papers about the plant by engineers of the company. These papers covered "General Concepts of the New Houston Works," "Water Supply and Steam Generating Facilities," "Power Generation and Distribution for Electrolytic Production of Chlorine and Caustic," "Brine Treatment and Caustic Concentration," "Chlorine Production and Liquefaction," and "Solid and Flake Caustic Installation."



This extractive distillation unit is one of six pilot plants at Sinclair's new development center in Harvey, Ill.

During the afternoon inspection trips were made at the plant. Following inspection, addresses were scheduled to be made by George W. Brown, vice president, Brown and Root, Inc., builder of the plant; A. H. Ingley, operations vice president, Diamond Alkali; C. E. Lyon, general manager of the Houston plant; and Dr. T. S. Painter, president, University of Texas. A barbecue dinner at the plant was slated as the last event on the program.

Standard of California Will Make Sulphuric at Richmond

HYDROGEN sulphide gases formerly burned at the Richmond, Calif., plant of Standard Oil Co. of California will now end up as sulphuric acid for western industry. To do the job of recovering the H_2S, a new Girbotol DEA unit has been erected at a cost of approximately $500,000. It has a daily feed capacity of 17,000,000 cu.ft. of gas from which 50-70 tons of H_2S can be recovered. Three separate streams of gas from the refinery can be treated in the one recovery unit. After being contacted by the diethanolamine-water solution, the H_2S is piped to the Richmond plant of General Chemical Co. for burning and conversion into H_2SO_4. Standard Oil has a similar recovery unit at its El Segundo refinery which was the first plant of its type ever constructed.

The Girbotol unit has several unusual features. It is completely housed

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MEK has been found to be outstanding as an active solvent for nitrocellulose lacquers, as well as for fabric and surface coatings based on the various vinyl resins. It is also successfully used in the manufacture of adhesives and cements which utilize Buna-N and neoprene rubber.

Other important products in which MEK finds application are can coatings, paint and varnish removers, rubber chemicals and printing inks.

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Toluene	4.4
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Viscosity (8% RS ½ second Nitrocellulose solution at 25°C)	10 centipoises
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Rate of evaporation (normal butyl acetate = 1.0)	4.6

A letterhead request to any of the Shell Chemical offices listed below will bring you technical literature and a sample.

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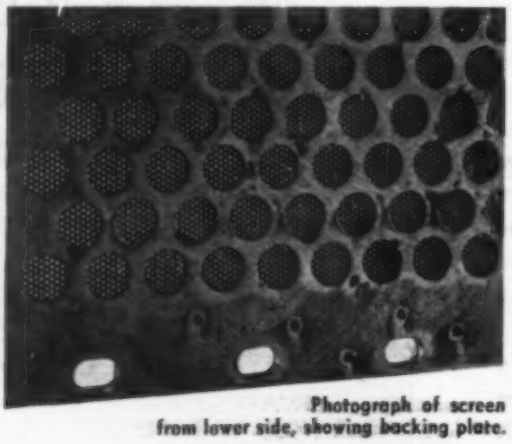

Photograph of screen from lower side, showing backing plate.

Some processes require so fine a screen that unless supported it could not withstand normal operations. To make it possible to use screens with extremely fine perforations, Hendrick furnishes backing plates, as shown in the illustration. This stainless steel screen has .060" round perforations. The backing plate is steel with 1" perforations, and does not need to be changed when the screen is renewed.

Whatever kind of screening your manufacturing processes involve, let Hendrick quote on screens made to meet your specific needs.

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in an all-welded structure to increase the safety factor. Louvers near the top of the building admit air to dilute any H_2S that may have leaked out; the dilute mixture is discharged through a stack about 80 ft. above ground level. Only two such completely enclosed units are operated in this country. The Richmond plant is characterized by extreme use of automatic control and safety devices; it is operated completely by remote control.

Celanese Plans to Add to List of Products at Bishop

PLANS for a considerable long-range expansion of the Chemcel plant of Celanese Corp. of America at Bishop, Tex., near Corpus Christi, are apparent from a recent large increase in the company's land holdings there. Within the last three months, separate purchases of land adjacent to the plant have brought the total to more than 1,500 acres, of which about 500 acres is in the present plant.

A few months ago the following chemicals were being offered for de-

CONVENTION CALENDAR

Commercial Chemical Development Association, winter meeting, Chicago, Ill., January 19, 1949.

American Society of Heating and Ventilating Engineers, 9th International Heating and Ventilating Exposition, International Amphitheater, Chicago, January 24-28.

Chemical Market Research Association, winter meeting, Biltmore Hotel, New York, February 10.

American Institute of Chemical Engineers, regional meeting, Los Angeles, Calif., March 6-9.

American Chemical Society, 115th national meeting, San Francisco, Calif., March 27-April 1.

American Society of Brewing Chemists, annual meeting, Roosevelt Hotel, New Orleans, April 10-14.

American Ceramics Society, national meeting, Netherlands-Plaza Hotel, Cincinnati, April 24-28.

Electrochemical Society, spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 4-7.

American Oil Chemists Society, annual meeting Hotel Roosevelt, New Orleans, May 9-10.

Manufacturing Chemists Association, annual meeting, Skytop, Pa., June 2.

22nd Exposition of Chemical Industries, Grand Central Palace, New York, November 28-December 3.

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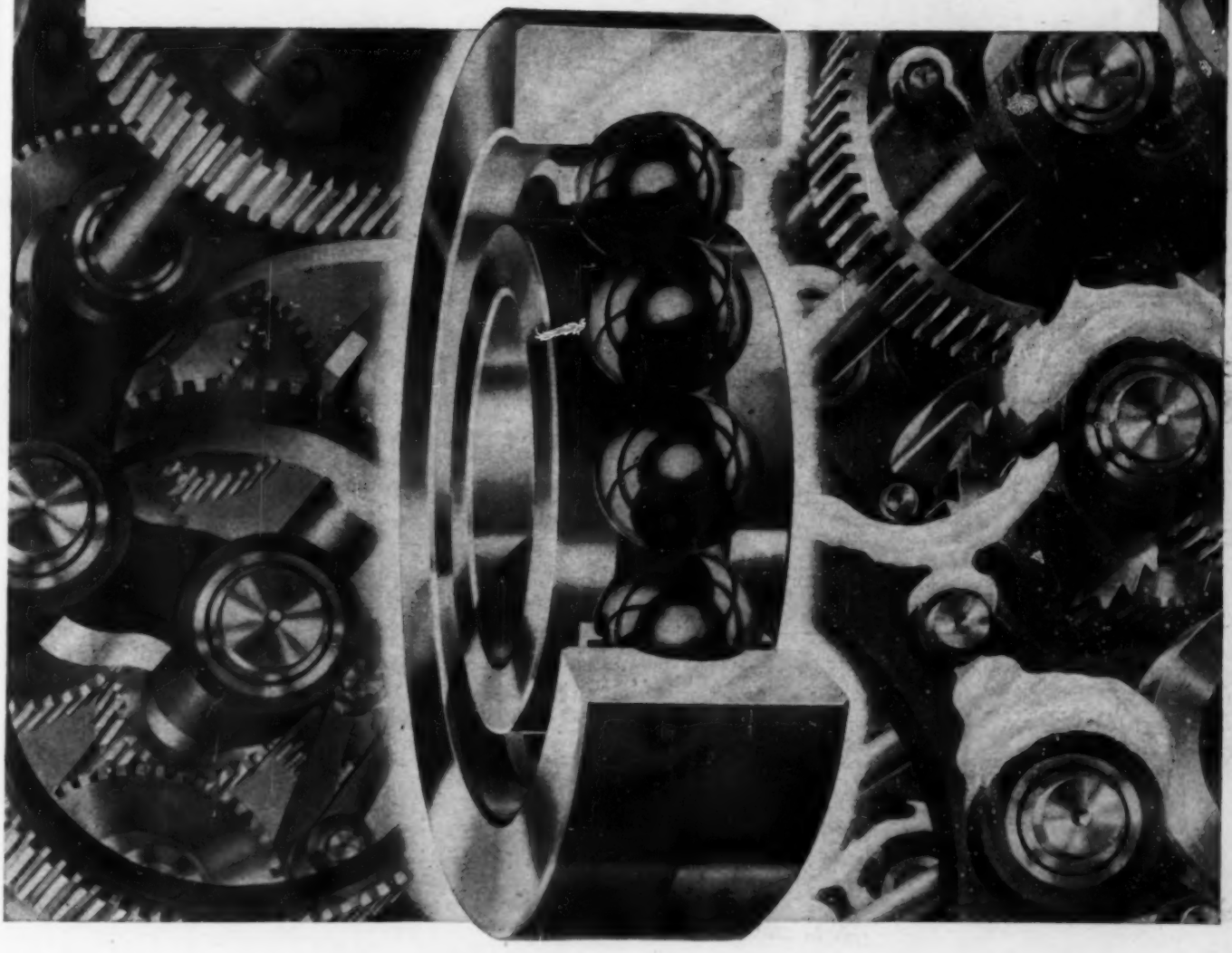
in a Furnace . . . or a Freezer!



New Lubricants by Socony-Vacuum Meet Extreme Conditions

You'll find the worst weather in the world in modern industry . . . from sizzling hot spots of 300 and 400°F., to chilling cold far below zero.

To protect bearings under these extreme conditions, Socony-Vacuum has developed two new special lubricants. Gargoyle Grease BRB Hi-Temp resists deterioration on bearings inside kilns, ovens, driers and other hot spots. Gargoyle Grease BRB Zero remains soft, resists drag on bearings in cold storage and pre-cooler rooms and outdoors in Arctic weather. It still gives satisfactory service at normal temperatures.

Here again is another example of our Complete Lubrication Service for your plant—service that has grown through 82 years' experience to help you keep your bearings.

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Correct Lubrication

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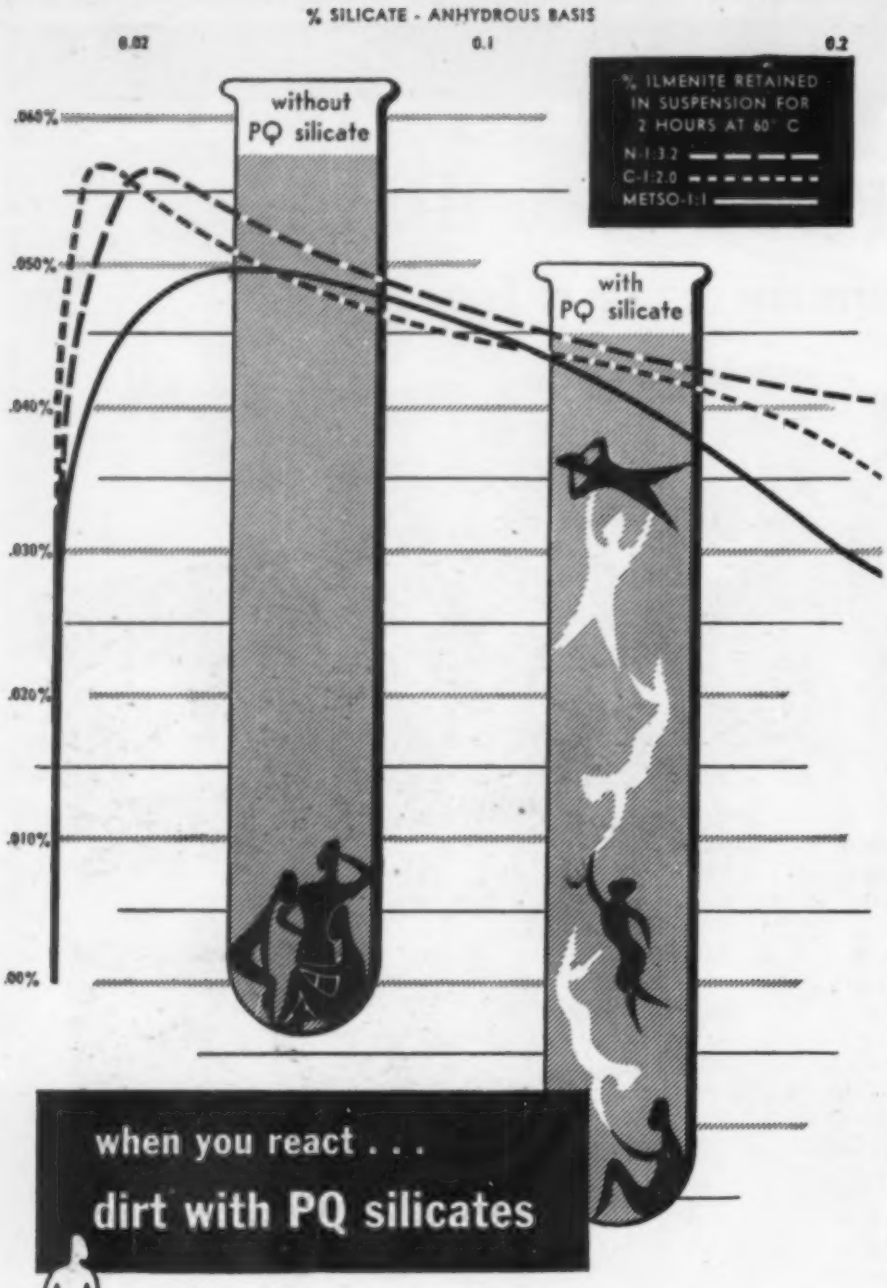

Dirt gets a move on! PQ Silicates (alkaline power plus soluble silica) wets, emulsifies, and deflocculates dirt and keeps it suspended. The above illustration charts the performance of three PQ Detergent Silicates in deflocculating and suspending dirt (Ilmenite).

Details of research studies with pigments such as ferric oxide, ground mica, graphite, coal, carbon black, vermilion, ultramarine, burnt and raw umber are also available.

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livery from Chemcel: acetaldehyde, glacial acetic acid, acetone, formaldehyde, isopropanol, methanol, n-propyl alcohol, mixed butyl alcohols and methylal. Scheduled to be available soon were propionaldehyde, 2 methyl, 1-3, pentanediol and special solvents.

First Oil Shale Arrives at Baton Rouge for Processing

THE FIRST carload of oil shale to be processed experimentally by the Esso Laboratories in collaboration with the Bureau of Mines has reached the Esso Standard Oil Co. refinery at Baton Rouge. Furnished by the Bureau from deposits at Rifle, Colo., the shipment was the first of a 1,000-ton batch that will be processed by Esso.

The work is being done on a pilot plant scale using a two-vessel unit embodying the principle of fluidized solids widely employed in catalytic cracking of petroleum. The shale is reduced to the pulverized state and charged into a retorting vessel where the material is heated to around 900 deg. F. by means of contact with a stream of hot, spent shale continuously entering the base of the retort from a combustion vessel. Vaporization and cracking of the oil into gasoline and other hydrocarbons occurs. Part of the spent shale, containing a small amount of residual carbonaceous matter, is discharged from the retort into the combustion vessel and burned to furnish the hot shale referred to above.

Standard Oil Development engineers who worked out the process say that considerable development work must be done before oil from shale can be brought into competition with crude petroleum. The cost of mining shale is at present one of the major items of shale oil production.

More Phosphates From Victor Expansion

START of operations at Victor Chemical Works' new Morrisville, Pa., plant, was announced in November. This increases the number of plants operated by Victor to five. It is the second to be completed in its postwar expansion program started in October 1947, construction at Morrisville has been completed on schedule. The new plant will produce phosphoric acid and other phosphate compounds, and will supply consumers in the East and on the Pacific Coast. The plant is under the supervision of E. L. Conant, superintendent.

Elemental phosphorus, used at Morrisville in the production of phosphoric acid and other phosphates, will

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The top band of the continuous belt passes over a trough of circulating water. In operation, the water pressure is just enough to raise the belt off its supports. The surplus water overflows into gutters which collect and return the water for recirculation.

That means 100% coolant contact with the underside of the belt. Furthermore the entire conveying band runs in an air conditioned "tunnel"... a metal duct through which a suction fan pulls a continuous draught of clean, cool air. You get tremendous cooling capacity plus the strength, impermeability and resistance to heat, wear and corrosion inherent in the stainless steel belt.

Tapered rubber strips fitted to the edges of the flat, stainless belt hold the liquid chemical on the belt surface.

The width and length of the belt, speed of operation, temperature of the cooling or heating medium etc. all depend, of course, on the requirements of the individual application.

Sandvik can design and build a steel-belt conveyor, with or without the Patented Water-bed arrangement, to fit your specific needs. Write for further information.

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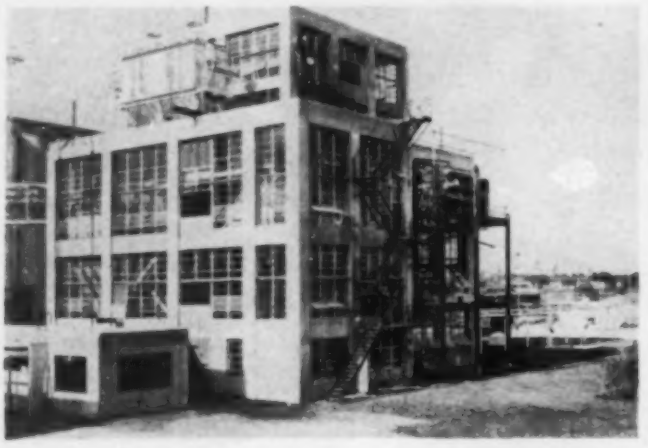
be shipped from Victor's phosphorus producing plants located at Mt. Pleasant, Tenn., and Tarpon Springs, Fla. The new plant will greatly increase the company's production. Additional capacity at Victor's Chicago Heights and Nashville processing plants is also nearing completion.



More Solvent Extraction

Solvent extraction at Corn Products Refining Co.'s Argo, Ill., plant is now carried out in this modern 225 ton solvent extraction unit built by Allis-Chalmers Mfg. Co. This is one of several solvent extraction plants completed in recent months.

California Plant to Use H_2S For Sulphur Output

NEAR Long Beach, Calif., Hancock Chemical Co. is now completing a plant which will convert hydrogen sulphide from nearby petroleum refineries into 50 tons of elemental sulphur daily. In addition to giving the local atmospheric pollution problem a push in the right direction, this unit will be a triumph in two other ways: (1) it will represent the first major sulphur production in the West, and (2) it will be the only operation of its type outside of three smaller units in Iran and two in Arkansas.

Basically, the plant combines a Gir-

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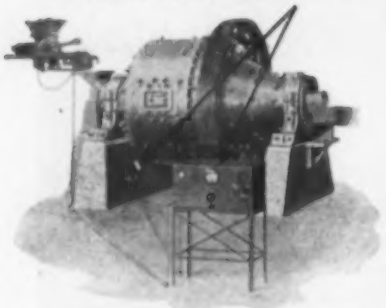
"ELECTRIC EAR"*



The Hardinge "Electric Ear"* is the only device of its kind that maintains maximum grinding mill capacity by "listening" to the sound of the mill charge. It compensates—electronically—for changes in grindability due to variation in hardness, size or density of the feed—producing a more uniform product, increasing mill capacity, and freeing the operator for other duties.

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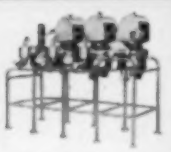

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botol DEA extraction unit with an application of the Simon-Carves process. In the first step, Girbotol extraction units at nearby Texas, Richfield Oil and Union Oil Co. refineries absorb hydrogen sulphide from waste gases in an 80 percent aqueous solution of diethanolamine. This solution is piped to the Hancock facilities, heated in an exchanger and run into a 50-ft. stripper with 16 trays operating at 10-20 psi.

Hydrogen sulphide (containing some carbon dioxide) from the stripper passes through two condensers and into a reflux drum. The amine-free hydrogen sulphide flows into a knock-out drum where the pressure is adjusted to 5-12 psi. Partial combustion of the hydrogen sulphide, using air blown in at 5-12 psi., takes place in a burner to form a limited amount of sulphur dioxide. The small amount of elemental sulphur formed is tapped off from the waste heat boiler, which operates at 3-5 psi. After leaving a cyclone, where sulphur fines are removed, reaction gases pass through the chamber of an auxiliary burner.

Final conversion to liquid elemental sulphur takes place in a catalyst-filled converter. Reaction takes place at about 2-4 psi.; only product in addition to the sulphur is water, which passes off as a vapor mingled with unused H_2S and SO_2. These gases are run through a second cyclone, auxiliary burner and converter, and into a scrubber, where the final particles of sulphur are removed. Liquid sulphur is collected in an underground tank, from which it may be pumped for shipment to local sulphuric acid plants.

Plant manager, and the man who supervised construction, is Hugh J. Gribben. E. B. Badger & Sons Co., New York, designed the sulphur production unit and built the entire plant. Hancock Chemical Co., headed by W. T. Hancock, plans a second unit as soon as the present one is in full operation. It will utilize H_2S from the nearby refinery of General Petroleum Corp.

New Engineering Firm Set Up in Northwest

THE FIRST regional firm in the Northwest to specialize in providing a completely integrated development and engineering service to the chemical and related industries of the area has recently been organized in Seattle. Northwest Industrial Development & Engineering Co., better known as Nidec, will offer services in initial planning, market surveys, research and development, design, plant layout, construction and supervision of start-up. In addition, the firm plans to initiate

Satincast
THE "NEW LOOK" IN
COOPER
STAINLESS STEEL
FITTINGS
Satincast, smooth as satin itself . . . is a newly developed finish by COOPER ALLOY which is Standard on all COOPER Stainless Steel Fittings. Satincast finish is also available on Special Castings of moderate size.
T.M. REG. PENDING
LUSTRACAST
by COOPER
This famous COOPER ALLOY electrolytic polish for fittings and castings brings out the natural brilliant luster of Stainless Steel as well as greatly increasing its resistance to contamination and corrosion. Lustracast finish is available at a slight extra cost.
Specialists in Corrosion Resisting Stainless Steel
THE COOPER ALLOY FOUNDRY CO.
HILLSIDE, NEW JERSEY

There's more to

AGITATION

than just an AGITATOR—

and

I★P★E

FITS the Equipment to the Need

Multiple Curved and Pitched Blade Turbine Agitator for 9000 gal. ester gum reactor.

For years, the process industries have depended upon I★P★E for agitation requirements because of:

- **I★P★E's expert engineering approach to agitation problems—based on wide processing experience.**
- **I★P★E's dependable specifications for the type of agitator to best fit the job.**
- **The delivery of an agitator that will do its required work well—and long.**

Prominent among the I★P★E "Standard-Plus" units because of its wide adaptability, is the

I★P★E TURBINE AGITATOR

—for dissolving, mixing and combination operations where high heat transfer rates are required. Successfully handles suspended materials in relatively high viscosity solutions.

In these operations, no single type of blade will meet all needs, I★P★E offers three styles for selection—each with its own particular function. Pitched blades for a high degree of axial flow motion; Curved blades for radial flow characteristics; Curved and Pitched blades in one unit for combination flow.

An added feature is the use of proper bearings and drives in accord with varying conditions.

Before making "an agitator" selection, consult I★P★E's Engineers—without obligation. You'll benefit from their expert, experienced advice.

1797

Other I★P★E Units Include

Agitators: Side-Entering Propeller Type, Top-Entering Propeller Type, Anchor Type, Paddle Type, Vertical Finger Type. Agitator Drives: Vertical, Right Angle Vertical. Processing Reactors, Kettles, Stills, Autoclaves, Absorbers, Dissolvers, Digesters, Crutchers, Dryers, Blenders, Crystallizers, Extruders, Condensers, Heat Exchangers, Mixers, etc.

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—ENGINEERS
—DESIGNERS
— MANUFACTURERS

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development of new industries geared to the resources, needs and economy of the area.

Nidec's services will be based on its diversified and integrated technical personnel and facilities. Principals include E. G. Putnam, professional engineer and owner of E. G. Putnam Co., who has had 20 years of experience in design and construction of food and chemical plants in the Northwest; R. M. Willis, chemical engineer-owner of Standard Chemical Engineering Co., who has been active in industrial process and design work for over 12 years; A. F. Simonson, who has practiced as an architect for 12 years and who heads his own firm in Seattle.

Other personnel include George Henderson, a chemical engineer with 11 years' experience as a design and construction engineer with Dow Chemical Co.; C. E. Putnam, best known for his 40 years' experience as a civil engineer in the waste disposal and water supply fields; H. S. Wright, head of Howard S. Wright Co., Inc., who has long been active in the industrial construction field in the area. Retained for research and development work are T. H. Williams, chemist, and C. V. Smith, chemical engineer, of the well-known Northwest Laboratories which has recently developed a new commercial process for making hardboard from waste wood.

The firm is now working on projects in the Northwest that range from a new synthetic ammonia plant to waste disposal processes.

Shale Oil Attracts Attention As Rifle Project Progresses

SHALE oil is a black, viscous liquid with a high pour point, containing up to 2 percent nitrogen. It is highly unsaturated, has a high sulphur content. Straight-run shale-oil gasoline, comprising less than 5 percent of the still run, has an octane rating below 60, is high in ring-type sulphur, tar acids and tar bases, and is gum forming and extremely unstable in color. The diesel oil fraction is of marginal quality having a low octane rating.

But, several major oil companies are pouring millions of dollars into oil-shale research. Of most importance, however, is the new refining unit of 200-bbl. daily capacity now getting under way at the Rifle, Colo., demonstration plant of the U. S. Bureau of Mines. Briefly the refinery consists of thermal cracking to increase the proportion of gasoline and diesel fuel obtainable from a barrel of crude; distillation to separate the various fractions; acid treatment and doctor sweetening to improve product quality. Units in operation are: (1) a single-coil crack-

PROVED IN A WIDE VARIETY OF APPLICATIONS

APPROVED BY THE U. S. BUREAU OF MINES
APPROVAL NO. 1307

M·S·A

Chemox
SELF-GENERATING

OXYGEN BREATHING APPARATUS

Many months of use in major industries and fire fighting services have confirmed CHEMOX' wartime performance verdict . . . the simplest, lightest—only 13½ lbs., easiest-to-use oxygen breathing apparatus ever developed, and *the only apparatus generating its own oxygen for breathing in a replaceable chemical canister.*

The U. S. Bureau of Mines-approved Chemox Apparatus belongs in *your* plant safety picture! Chemox gives *complete* respiratory protection in atmospheres containing toxic gases, oxygen deficiency, or both—for forty-five minutes at hard work. See it for yourself in a readily-arranged demonstration, and meanwhile, write for Bulletin BM-14!

The Chemox Apparatus consists of an All-Vision facepiece with extra-large contoured lenses—exhalation and inhalation breathing tubes connecting to the Chemox canister—a tough, sturdy breathing bag made of heavy Neoprene—and comfortable harness designed for maximum wearing ease.

The complete assembly is simple to put on, quickly adjusted, and easy to wear.

MINE SAFETY APPLIANCES COMPANY

Braddock, Thomas and Meade Sts. Pittsburgh 8, Pa.

District Representatives in Principal Cities

In Canada: MINE SAFETY APPLIANCES COMPANY OF CANADA LIMITED

TORONTO · MONTREAL · CALGARY · VANCOUVER · WINNIPEG · NEW GLASGOW, N.S.

Producers of

SULPHUR

Large stocks at our mines make possible prompt shipments

Uniformly high purity of 99½% or better

Free of arsenic, selenium and tellurium

TEXAS GULF SULPHUR CO. INC.

75 East 45th St. New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

ing furnace operating under all conditions of atmospheric distillation, thermal cracking and reforming; (2) two coke chambers, one of which will serve as a reaction chamber during recycle cracking operations; (3) a flash fractionator; (4) an absorber to recover liquids; (5) a stabilizer to produce gasoline of the desired vapor pressure; (6) a continuous low-temperature acid treating unit; (7) a re-run distillation unit to remove high sulphur polymers from gasoline after acid treatment; and (8) a continuous doctor sweetening unit to convert objectionable odorous compounds.

Heading the Bureau's work at Rifle is Boyd Guthrie. Says he: "We believe industrial fuel oil can be produced with relatively simple refining equipment. But since shale oil differs from petroleum in many respects, it is possible that specialized equipment will be more effective for production of motor fuels." One such specialized technique that has been mentioned is hydrogenation.

New Plastics Report Available Monthly

DATA on shipments and consumption of plastics and synthetic resins will be released monthly in a report from the chemical division of U. S. Tariff Commission. The first of this series covered data for four months, from June to September of this year, and was released in November. This new series succeeds the old Census Bureau report which was discontinued for lack of funds.

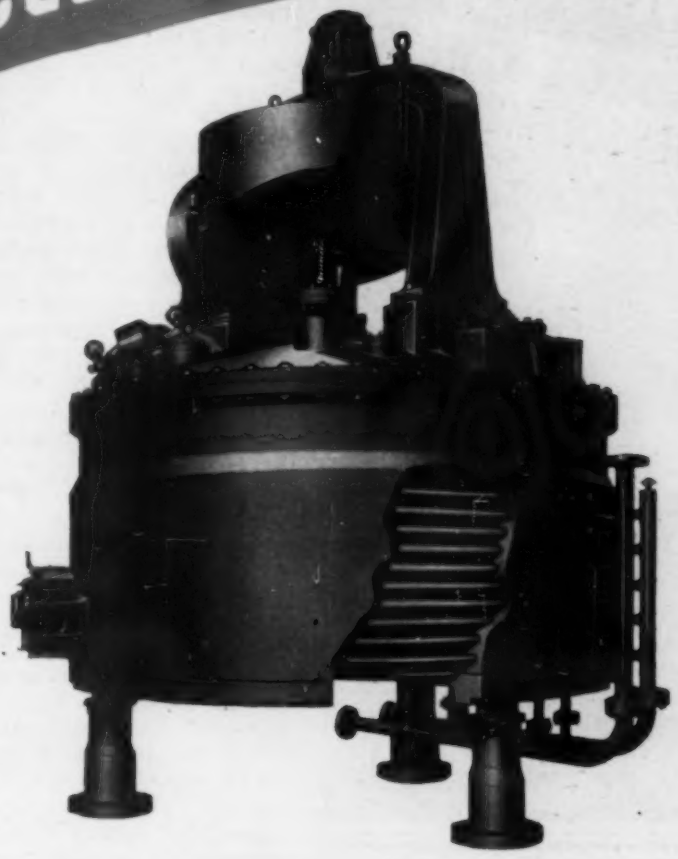
At the outset the new series will be identical in scope and detail. But the industry would like more elaborate figures and may get them before long. Two requests which Census could not comply with may be possible at Tariff. One would add data on coating resins. The other would give some breakdown of the data on certain vinyl resins. There is some chance that these changes may be made effective early next year.

Rubber Production Sets New Record

THE COMEBACK of the natural rubber industry is clearly indicated by Commerce Department data released during November. The figures show that world production of natural rubber is now at an annual rate of approximately 1,840,000 long tons. The September production was a new all-time record, the data show.

Comparable figures on world output of synthetic rubber indicate production and consumption about equal at a bit

PROCESSING EQUIPMENT



Proved and approved

BY LEADERS IN THE CHEMICAL INDUSTRY

Whatever your needs in heavy, scientifically developed processing equipment, Bethlehem can produce it for you. Processing equipment to your most exacting specifications . . . equipment and engineering services proved and approved by the leaders in the chemical industry.

If your process requires a heating or cooling stage select the Bethlehem Thermocoil—a unit that has made products more uniform and increased the efficiency in scores of plants. Its more rapid rate of thermal transfer, the ease with which heating and cooling can be alternated, and its structural ability to withstand rapid temperature changes, greatly accelerates the process.

In addition, Bethlehem facilities stand ready to produce kettles, high pressure autoclaves, heat exchangers, dryers, or any of a number of units you may need . . . built to your exact specifications. Bethlehem has specialized in the engineering and building of specialized chemical processing equipment for many years. The technical "know-how" of our engineering staff will prove of outstanding value to you in solving your processing equipment problems. For more details on the many facilities of Bethlehem write for our complete engineering catalog.

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J&C ZENITH
CONTINUOUS PULP PRESS

JACKSON & CHURCH COMPANY'S ZENITH CONTINUOUS PULP PRESS offers GREATER efficiency and GREATER profits . . . with the hydraulically - operated cake discharge port or "floating cone."

Long the finest dewaterer on the market, Zenith's new 100% automatic operation assures CONSTANT UNIFORM discharge pressure at any pre-determined degree. Finger-tip adjustment assures drier cake of uniform consistency.

These engineering triumphs . . . found only in Zenith Press . . . are available to paper pulp, cannery, corn starch, fish reduction, meat packing, glue, citrus waste drying and many other processes.

For further plant uses, for individual problems or for engineering or additional data, write Jackson & Church Company at Saginaw, Michigan.

A PRODUCT OF
JACKSON & CHURCH COMPANY, SAGINAW, MICHIGAN
"Work well done since '81"

PROTECT YOUR PLANT AGAINST GAS HAZARDS

A four point Davis Continuous Sampling and Recording Combustible Gas Alarm System

DAVIS REMOTE HEAD COMBUSTIBLE GAS ALARM SYSTEM measures flammable gases and/or vapor air concentrations in terms of their explosibility.

Analyzer Head located in area being sampled indicates the gas and vapor hazards under actual temperature conditions. Changes are communicated to—

Control Cabinet in gas free area. When concentrations have reached the alarm point:

1. Red "bull's-eye" shows area causing the alarm
2. Alarm bell in cabinet rings
3. External audible signal sounds in area causing the alarm

For complete technical details, write for Bulletin 1116-F.

INSTRUMENT DAVIS DIVISION
DAVIS EMERGENCY EQUIPMENT CO., INC.
60 Halleck Street, Newark 4, N. J.

over 40,000 long tons per month. Total consumption of natural and synthetic has been definitely less than the combined production so that world stocks have grown by approximately 40,000 long tons during the year. None of this increase is reported for the United States.

Perlite for Building Materials Pushed By Western Firm

PERLITE is a form of volcanic glass containing a small amount of water. When suddenly subjected to high temperatures, it expands up to 20 times its original volume. Perlite processing as a new building materials industry has been recognized only since 1940. In addition to operating its own expanders (or poppers), the AleXitE division of Alexander Film Co., Colorado Springs, Colo., sells classified perlite rock to individual producers throughout the country. Furnace designs, engineering plans and operating data are supplied to manufacturers east of the Rockies.

Perlite rock containing 75 percent silica is mined from large deposits near Rosita, Colo. After being broken into egg-sized pieces, it is processed in a closed circuit roll and screening mill which sizes about 25 tons of raw ore hourly. This is shipped directly to expanders throughout the country and to the firm's home plant.

At Colorado Springs, the company has two furnaces, the largest of which is a slanted, gas-fired rotary kiln with a capacity of some two tons hourly. Raw ore is introduced into the top end and heated to approximately 1,800 deg. F. As it is exhausted out the lower end, the six-fold expanded perlite is graded, cleaned and sacked.

Mississippi Gets New Ammonia Firm

MISSISSIPPI CHEMICAL CORP., an $8 million organization, has been formed in Mississippi to build a $12 million plant to manufacture anhydrous ammonia and probably ammonium nitrate for distribution to Mississippi farmers. The company has been organized following a drive, begun last year, by a farmer group called the Committee on Nitrogen Plant for Mississippi to sell shares to planters in the state. The drive had the support of the Mississippi Farm Bureau Federation.

The tentative capacity of the plant is 150 tons per day of anhydrous ammonia. It is contemplated that the company will produce ammonium nitrate as well as ammonia, although whether the nitrate will be made in

Extra measure of fire protection

Extra-long cotton fibers give added strength and safety to Maltese Cross Fire Hose

You will find that Maltese Cross Fire Hose *more* than measures up to your demands.

For more than 50 years this famous fire hose has been first choice of oil men who demand an *extra* measure of protection! It is easy to see why.

Hewitt builds the carcass of special, extra-long-fiber cotton duck. This gives the carcass *light weight with great burst-resistance . . . extreme flexibility with unusually long life.*

Another extra measure of protection is provided by highest quality rubber compounds in the cover. These make the cover durable and flexible . . . keep acid fumes and moisture from deteriorating the fabric.

As you know, it was impossible during the war to get some of these high-quality compounds, as well as cotton fibers of exceptional length.

So rather than lower quality, Hewitt temporarily stopped making Maltese Cross Fire Hose. Today, choice materials are again available. And so is Maltese Cross Fire Hose.

Get your order in *now*. Contact your Hewitt distributor listed in the classified pages of your phone book. Or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N.Y.

HEWITT
MALTESE CROSS
FIRE HOSE

Why Maltese Cross Fire Hose gives you an extra measure of fire protection

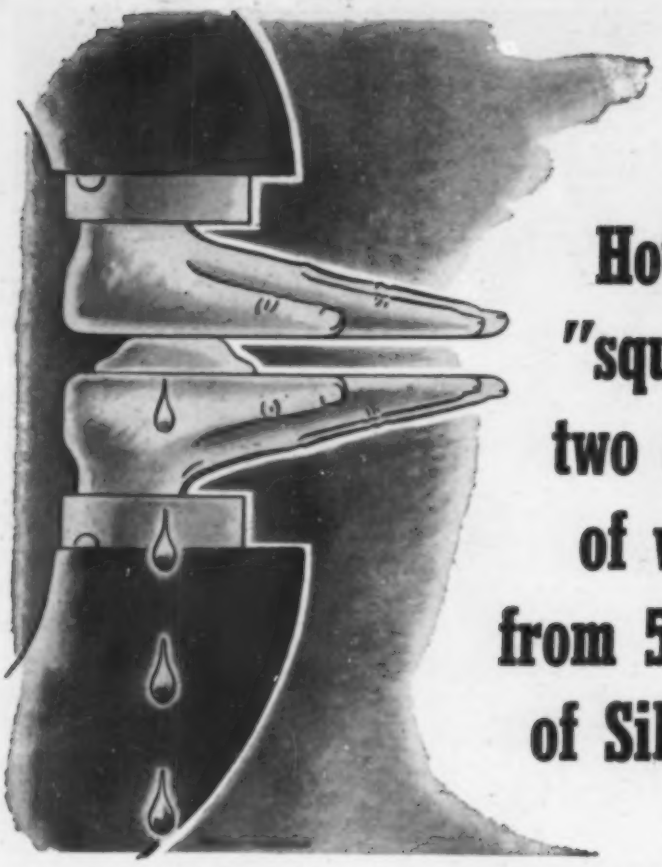
1. Long-staple, high-tensile duck makes this hose light in weight, flexible, highly burst-resistant.

2. Special chemical treatment protects duck against deterioration from mildew. This feature, combined with rubber cover, eliminates need for drying after use.

3. Highest quality rubber compounded tube, plus extra-tough cover, enables hose to withstand coiling for long periods of time without cracking.

4. Cover protects duck carcass from moisture and acid fumes. Also resists weathering and sun-checking.

HEWITT RUBBER DIVISION **HEWITT-ROBINS INCORPORATED**



How to "squeeze" two quarts of water from 5 pounds of Silica Gel

Silica Gel, a cracking catalyst for high octane gasoline, is almost 90% water by weight!* Refiners found the dehydrating methods they were using were far too expensive and slow. So they dumped their drying problem into Hersey's lap.

Months of careful analysis and testing in the laboratory bore fruit and the first of many Hersey Silica Gel Dryers was born. Working in two stages, these dryers first bring the free water content (wet basis) from 80.3% down to 50%. In the second stage, drying is completed as the total volatile is reduced to 3%.

Result: Faster, more efficient drying, **nearly 80% cheaper than the old method** . . . greater fuel economy . . . lower initial equipment cost.

For a successful solution to your drying problem, call on Hersey. No obligation for a consultation—write or wire today.

*As it comes from the filter press.

hersey
MANUFACTURING COMPANY

E & SECOND STREETS
SO. BOSTON, MASS.

the plant or made available by supplying ammonia to some other company has not been decided. Stockholders will have first claim on the output.

Leroy Thompson, formerly an engineer with TVA, has been named general operations director to determine a site for the plant, and is making a survey of natural gas and water supplies. Construction is expected to begin early next year.

John Sharp Williams, Yazoo City planter and lawyer, is president of the company. Other officers are Charles Whittington, of Greenwood, first vice president; Charles McNeil, of Jackson, second vice president; and Owen Cooper, of Jackson, executive vice president.

Bryan Expands Operations To Include Chemical Units

THOMAS BRYAN and Associates, an engineering design and construction firm heretofore primarily engaged in the construction of food processing plants, has opened offices in Houston and plans to become active in the erection of chemical plants and oil refineries. The firm moved from Lafayette, La., to Houston last fall. It intends to re-establish a former office in New York City after the first of the year, but Houston is slated to remain headquarters. The firm has a branch in Washington, D. C.

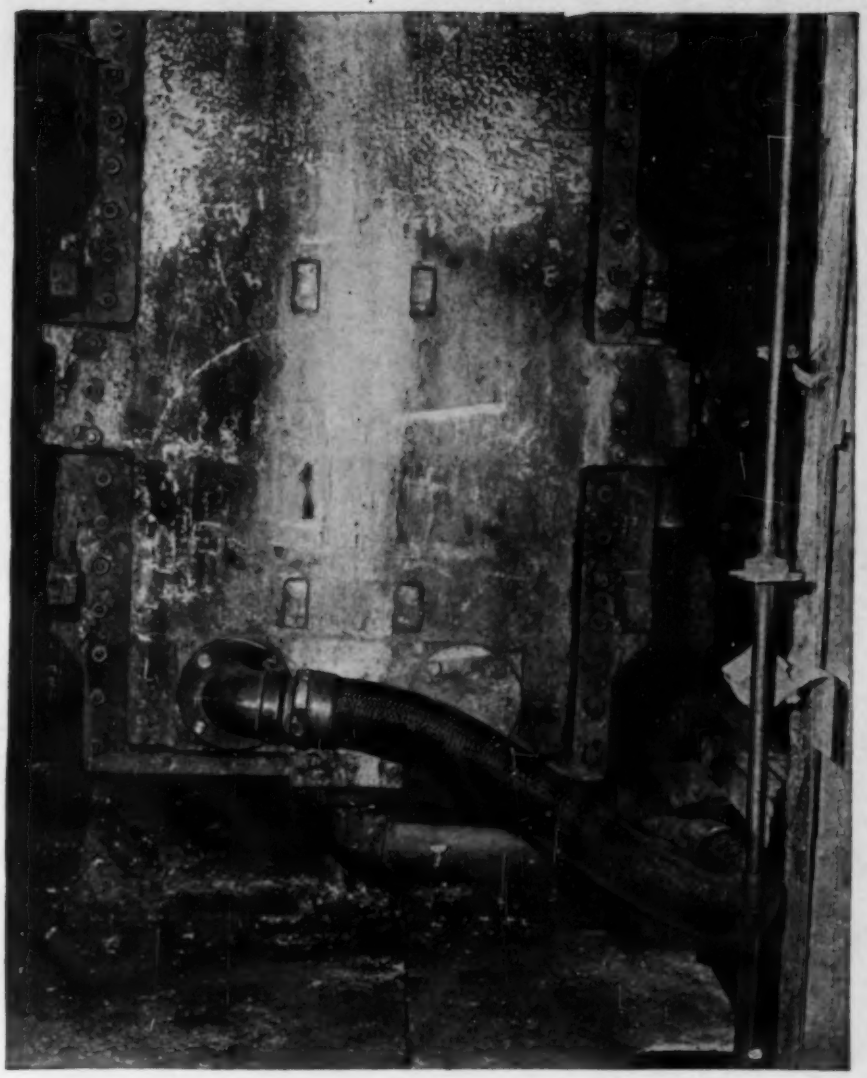
Noyes Heads New Chemical Warfare Group of RDB

DR. W. ALBERT NOYES, JR., professor of chemistry at the University of Rochester has been named chairman of the new committee on chemical warfare of the National Military Establishment's Research and Development Board. The committee will deal with all aspects of the field of chemical warfare, including flame throwing chemicals, smoke and fog screens, and other highly specialized chemicals of warfare—as well as the defensive aspects of chemical warfare.

New chairman of the Chemical Corps Advisory Board, replacing Dr. Noyes, is Dr. H. F. Johnstone.

More Tariff Cuts Planned by Pacts

Most of the proposed reductions in tariff rates being currently considered are not significant in chemical process industry. But sprinkled through six large pages of fine print announced by U. S. Tariff Commission are a number of important items of this sort. For example in the Swedish negotiations



This American Seamless Flexible Connector leads a hard life on a water-cooled mold in the brass casting shop of the Winchester Repeating Arms Company plant at New Haven, Conn.

AMERICAN SEAMLESS

takes knock-down-and-drag-out routine at Winchester Repeating Arms Casting Shop

Here a troublesome problem is solved with American Seamless Flexible Bronze Tubing, 3″ I.D., strengthened with a covering of bronze wire braid. We supplied it with special couplings soldered on.

By substituting this rugged flexible metal connector for the original rigid line, Winchester engineers eliminated time lost in connecting and disconnecting this mold after every cast. In handling spent coolant water at 140° F. and 75 to 100 lb. pressure, this connector retains its flexibility despite the spatter of molten brass.

If you have a problem in conveying water, steam, oil or other liquids, semi-solids or gases; in meeting misalignment, eliminating vibration, connecting moving parts, or piping in cramped places, "American" engineers can help you. They will design connections to fit your job, complete with special end fittings. *No extra charge* for our engineering service.

There are many types of American Seamless Flexible Metal Tubing and Flexible Metal Hose for many uses. Write for information and feel free to consult our Technical Department at any time.

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METAL HOSE

THE AMERICAN BRASS COMPANY

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Subsidiary of Anaconda Copper Mining Company

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THE CANADIAN-FAIRBANKS MORSE COMPANY, LIMITED

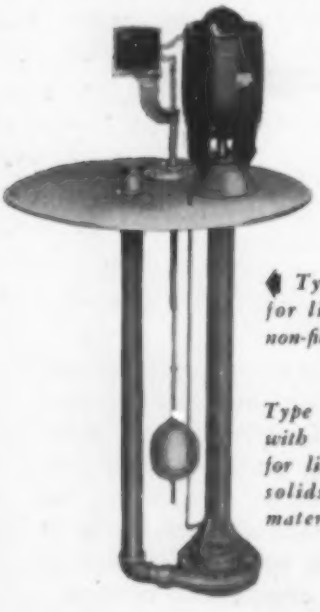
Uniformity of Product

Calls for Dependable Pumping Service

Liquid handling is but one phase of readying your product for the market-place. Yet unless this production step is carefully taken, quality — then product acceptance — start to decline.

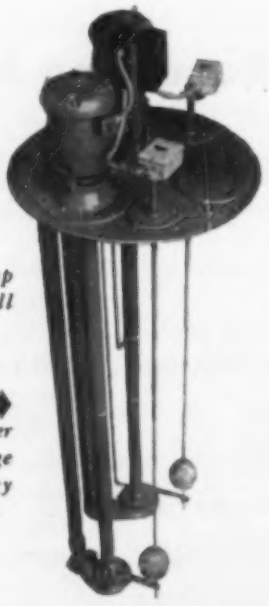
WEINMAN Centrifugal pumps have been in continuous service in the chemical industry for nearly 60 years. Various modifications and sizes of these Weinman pumps, constructed of all bronze, all iron, all aluminum, all nickel and all stainless steel are doing daily duty in every size plant for every fluid handling task. Acid resisting zincless bronze construction available from Weinman is unsurpassed for brine solutions.

Feel free to discuss your pump problems by letter, wire or phone with Weinman Centrifugal specialists.



Type GAV Sump Pump for liquids carrying small non-fibrous solids.

Type UVS Sump Pump with non-clogging impeller for liquids containing large solids, fibrous or stringy material.



Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

300 SPRUCE STREET • COLUMBUS 8, OHIO

is the proposal that a cut be made in the rates on caustic potash and caustic soda.

All of these proceedings represent the post election effort of official Washington to prepare for new trade agreements with nine countries. Initial hearings regarding details were scheduled to begin December 7 covering the long list of commodities above referred to. Details were published in Federal Register of November 6.

Indexes

CONTINUING the practice started by *Chem. & Met.* several years ago, printed below are indexes for Reports and Pictured Flowsheets published to date.

An Index to *Chemical Engineering* Reports, 1926-1948

Air Separation Mar. 1947
Alcohol for War and Postwar Aug. 1943
Atomic Energy Oct. 1946
Award for Chemical Engineering Achievement Nov. 1943; Dec. 1947; Oct. 1948
Bulk Packaging of Chemicals Oct. 1943; Apr. 1948
Canada's Chemical Industry Aug. 1948
Catalysis Oct. 1942
Centrifugal Separation July 1943
Ceramic Industry July 1948
Chemical Engineering Design Apr. 1931
Chemical Engineering Looks Abroad Feb. 1945
Chemical Engineering, Middlewestern Aug. 1946
Chemical Engineering Outlook Feb. 1947
Chemical Engineering Progress Feb. 1946
Chemical Engineering, Yesterday, Today & Tomorrow Feb. 1944
Chemical Exposition Mar. 1946
Chemical Exposition & Power Show Dec. 1942
Chemical Manpower Jan. 1941
Chemical Requirements of Petroleum Refining Jan. 1946
Chemicals From Petroleum Dec. 1945
Chemicals From War to Peace Jan. 1946
Chemicals in the National Economy Nov. 1940
Chlorine Industry Aug. 1944
Conditioning of Gases & Air May 1940
Continuous Processing May 1945
Costs of Process Equipment; May; 1947; Dec. 1941
Diffusional Operations May 1942
Economic Balance Sept. 1946
Electronic Devices Mar. 1942; Apr. 1942
Engineers in War and Postwar Mar. 1944
Equipment Cost Estimation May 1947
Equipment Progress Mar. 1946
Facts & Figures Sept. 1937; Sept. 1939; Feb. 1940; Feb. 1941; Feb. 1942; Feb. 1943; Feb. 1944; Feb. 1945; Jan. 1946; Feb. 1947; Feb. 1948
Fermentation Dec. 1947
Filtration Jan. 1944
Fire Protection Methods Aug. 1942
Fluids Handling May 1937
From Mine, Farm & Forest Oct. 1944
Fuels for Process Industries Mar. 1941
Fuels, Synthetic June 1948
Fuel Technology Apr. 1947
Gas Turbines Dec. 1946
Going to Full Scale Oct. 1947
Government Property Disposal Apr. 1944
Handling Materials With Trucks Nov. 1945
Heat Transfer May 1944
High-Octane Aviation Gasoline June 1943
High-Pressure, High-Temperature Technology Sept. 1930
Ion Exchange July 1947
Industrial Waste Aug. 1945
Integration of Facilities Sept. 1945
Labor Relations Jan. 1943
Latin America July 1944
Lubrication Mar. 1940
Management & Labor Relations Apr. 1945
Maintenance of Lamps & Motors Mar. 1943
Maintenance in Process Industries Dec. 1940
Market Research May 1946
Materials Handling Nov.1945; Dec. 1948
Materials of Construction Oct. 1926; Sept. 1928; Sept. 1929; Sept. 1932; Oct. 1934; Oct. 1936; Nov. 1938; Sept. 1940; Sept. 1942; Sept. 1944; Nov. 1946; Nov. 1948.
Measurement & Control of pH Aug. 1940

DU PONT REPORTS

OUTSTANDING PERFORMANCE OF "TEFLON" FOR GASKETS IN CHEMICAL INDUSTRY

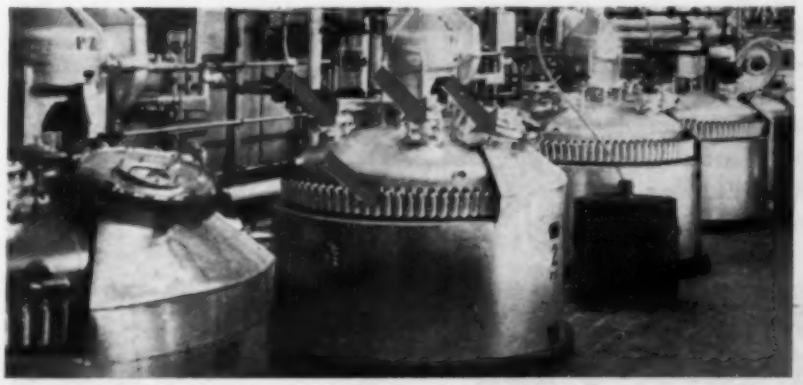
These "French-type" gaskets . . . of metal, rubber, and asbestos . . . are protected by an inert shield of "Teflon." This plastic is also used alone as a gasket material.

- **INERT TO ALL CHEMICALS**
  (Except molten alkali metals and fluorine at elevated pressures and temperatures)
- **OUTLASTS OTHERS UP TO 25 TIMES**
- **EXCELLENT HEAT-RESISTANCE**
  (Temperatures up to 550°F.)

High pressure reaction kettle, with gaskets covered with "Teflon," made by Pfaudler Co., Rochester, N. Y. Pfaudler also uses and recommends gaskets of "Teflon" on other units. Pfaudler says, "Gaskets shielded with 'Teflon' have been successfully used on our equipment under highly corrosive conditions, under which gaskets of other materials have failed."

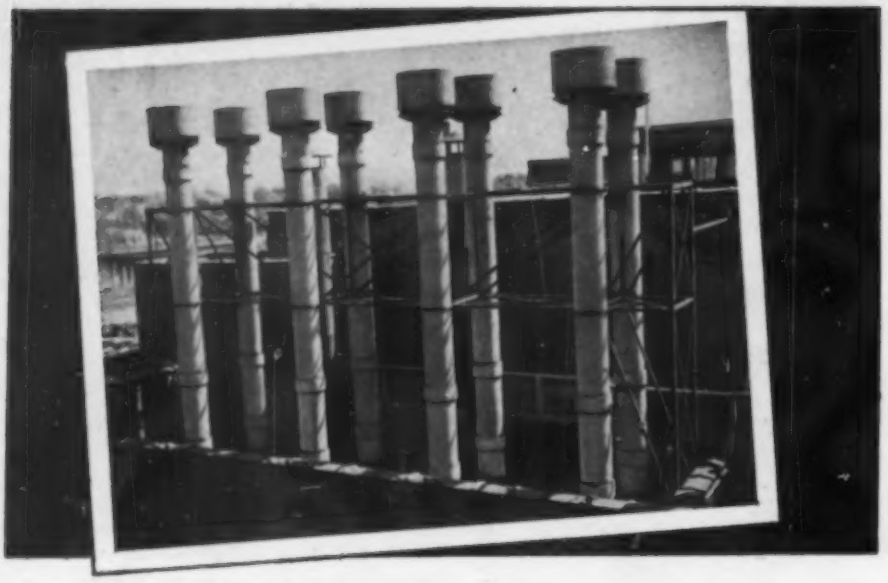
DU PONT'S unusual "Teflon" tetrafluoroethylene resin shows excellent resistance to temperatures from −100°F to 550°F. . . has good dimensional stability . . . is inert to all chemicals (except molten alkali metals and fluorine under extreme conditions). Gaskets of "Teflon" have been used successfully in contact with bromine, chlorine, sulfur dioxide, concentrated sulfuric acid, aqua regia, thionyl chloride, organic solvents including halogenated hydrocarbons, etc. They have been used for *over a year* in operations where other gaskets have lasted *only two weeks*. **"Teflon" is superior in chemical resistance to any other known gasket material.**

Perhaps "Teflon" can solve a tough problem for you. Du Pont supplies "Teflon" as sheets, rods, tubes, tape and in a shredded form. Write today on your letterhead for more information. Our technical staff will welcome the opportunity to discuss your problem and suggest possible uses of "Teflon." If you wish, we will supply names of gasket manufacturers. E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 1012, Wilmington 98, Del.



PFAUDLER KETTLES used by Ciba Pharmaceutical Products, Inc., in making pyribenzamine. Ciba reports, "Gaskets of 'Teflon' have served in these kettles *over a year*. Others deteriorated *within a few weeks*."

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



Records show long service in tough service . . .
for Transite Industrial Vent Pipe

In installations in many industries where corrosive fumes, vapors, dusts, and gases are encountered, Transite Industrial Vent Pipe is yearly demonstrating the fact that it is a practical, economical answer to tough venting problems.

Workable: Transite can be cut and drilled on the job.

Because it is an asbestos-cement product, this strong, durable pipe stands up in many types of corrosive service . . . helps avoid costly replacement . . . results in important reductions in plant maintenance.

Easily installed—Transite Industrial Vent Pipe has many practical installation advantages. It is light in weight and easily handled. It is readily worked and can be quickly cut and drilled on the job with ordinary tools.

Easily adapted—Made in a range of sizes up to 36" in diameter, Transite Industrial Vent Pipe is readily adapted to use as vents, ducts, and stacks. A full line of Transite fittings provides a venting system that is corrosion resistant throughout.

Adaptable: A complete line of Transite fittings meets most job requirements.

Economical to maintain—Transite is completely rust-proof... highly weather resistant . . . needs no painting . . . resists corrosion outside, inside and all the way through. For full details about Transite Industrial Vent Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

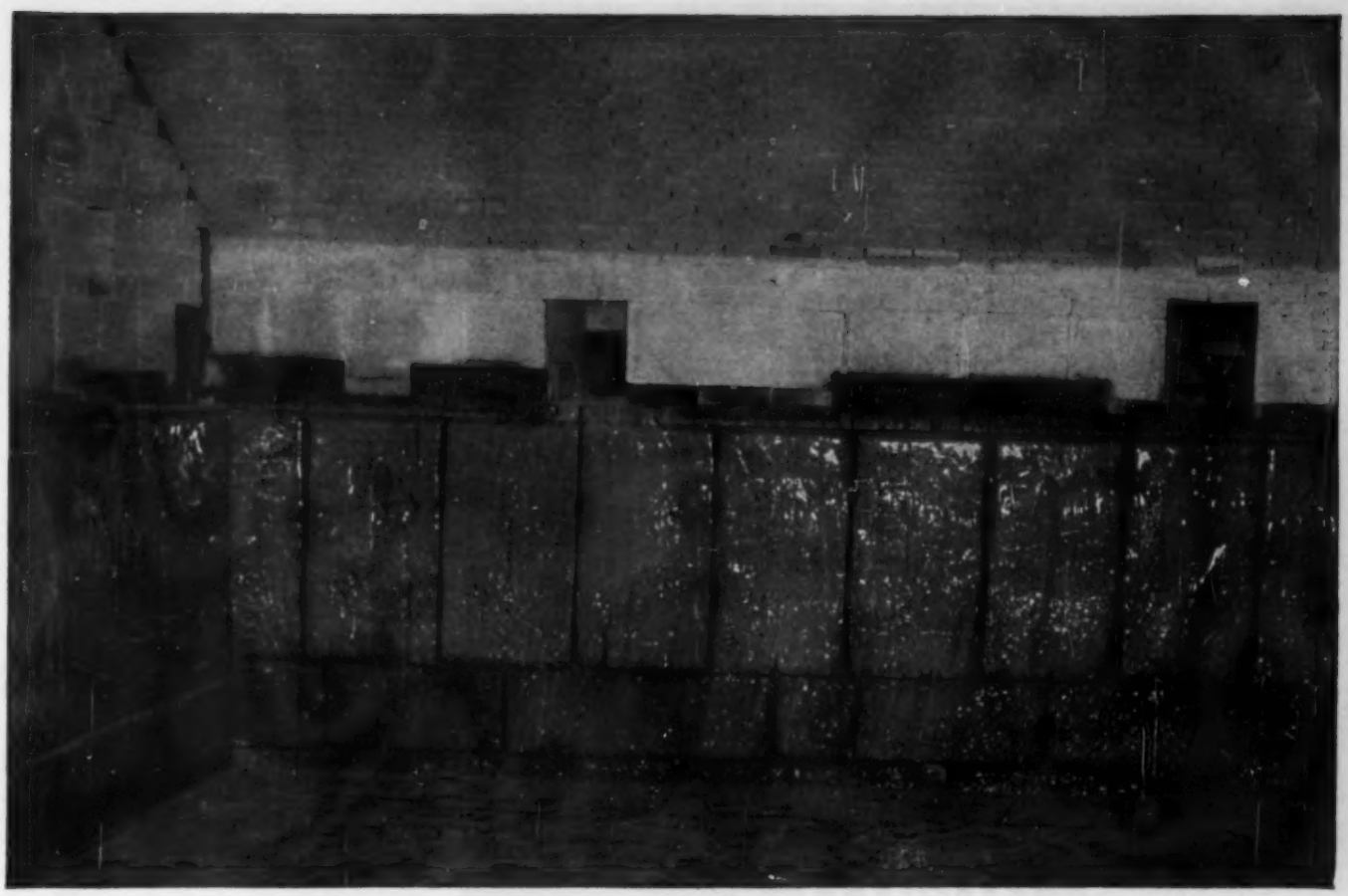
JM PRODUCTS

Johns-Manville TRANSITE Industrial Vent PIPE

Measurement & Control of Process Variables	May 1943
Mechanical Handling	Apr. 1930
Mechanical Maintenance	Apr. 1943
Mechanical Power Transmission	July 1940
Mechanico-Chemical Processing	May 1938
Middle Western Progress	Aug. 1946
Middle Western Resources	Nov. 1942
Midwestern Chemical Industries	Apr. 1941; Sept. 1948
New England	Sept. 1943
New Tools for Process Control	July 1945
Opportunities in Petroleum Refining	June 1940
In Pulp & Paper Industry	Apr. 1940
In Synthetic Organic Chemicals	Oct. 1941
In Textile Industry	Mar. 1948
Oxygen	Jan. 1947
Pacific Northwest	June 1944
Pacific Progress	Sept. 1947
Paints & Varnishes	Nov. 1944
Petroleum Processing	June 1945
pH Measurement & Control	Aug. 1940
Planning Research	Aug. 1947
Plant Design & Construction	May 1941
Plant Lighting	Jan. 1940
Plant Lubrication	Mar. 1940
Plant Protection in Wartime	Jan. 1942
Plant Safety & Fire Protection	Oct. 1940
Postwar Prospects	Feb. 1943
Power Show	Dec. 1942; Dec. 1944
Process Control	Apr. 1929
Process Equipment Design	May 1939
Process Improvement	June 1947
Process Steam & Power	Aug. 1941
Production, Application & Transfer of Heat	May 1944
Public Relations	Oct. 1938
Recent Advances in Fermentation	Dec. 1947
Small Business	Dec. 1944
South America & West Indies	Dec. 1943
Southern Chemical Progress	July 1941
Southwestern Progress	June 1942
Steam in Ch. E. Industry	Sept. 1927
Speeding Production	Nov. 1941
Surplus Property	Oct. 1945
Synthetic Fibers	Jan. 1945
Technical Service	Mar. 1945
Textile Industry	Mar. 1948
Unit Operations Appraisals	May 1934; May 1948
Unit Operations Development	Apr. 1935
Wartime Construction	July 1942
Waste and Process Planning	Aug. 1945
Waste Disposal & Byproduct Recovery	Sept. 1931
Water Supply	Jan. 1948
Water Treatment	June 1941
Weight Control	Apr. 1946
Western Process Industries	Sept. 1941
West Indies	Dec. 1943
What Fuel, How Efficient?	Apr. 1932

An Index to *Chemical Engineering* Pictured Flowsheets, 1939-1948

Acetic Acid (wood)	May 1940
Acid-Grade Fluorspar	Aug. 1945
Acid Regeneration	July 1946
Activated Sludge	Jan. 1941
Alcohol Byproducts	June 1945
Alcohol From Petroleum	Nov. 1945
Alcohol (molasses)	June 1939
Alkali Industry	Feb. 1946
Alumina	Oct. 1940
Aluminum Sheet	May 1943
Ammonia Soda Process	Feb. 1942
Ammonia Synthesis (TVA)	Nov. 1943
Ammonia (synthetic)	Dec. 1945
Amyl Alcohol and Acetate	July 1940
Aspirin	Mar. 1948
Ball Powder	Dec. 1946
Bauxite	May 1943
Bead Catalyst	Apr. 1946
Beer	July 1942
Beet Sugar	June 1949
Bromine (seawater)	Dec. 1939
Buna S Rubber	June 1943
Butyl Rubber	July 1943
Calcium Hypochlorite (and Mg)	Apr. 1945
Cane Sugar	July 1941
Carbon Dioxide	Feb. 1939
Casein and Lactic Acid	June 1940
Catalyst (synthetic bead)	Apr. 1946
Caustic Soda	Dec. 1942; Dec. 1948
Cellophane	Jan. 1939
Cellulose Acetate Yarn	Jan. 1945
Cement (wet process)	Oct. 1939
Chemical Cotton	Apr. 1941
Chlorine	Dec. 1942; Dec. 1948
Cigarette Paper	June 1946
Coke (byproduct)	Dec. 1941
Continuous Pulp Bleaching	Oct. 1947
Continuous Separation of Fatty Acids	Nov. 1946



7½ YEARS' SERVICE IS JUST A "DIVIDEND"!

THE photo above shows part of the refining end sidewall in a window glass tank which recently went down for repairs. The Corhart* Standard Electrocast top course is three fires (7½ years) old, and is still "in excellent condition," to quote the operator. In fact, "6 inches of the original 8-in thickness still remain."

Please note, however, that this long life is actually only a secondary dividend. *The Corhart Electrocast blocks were originally installed to reduce refractory contamination.* Had the Corhart Electrocast products fulfilled that one purpose *alone*, the installation would have been considered successful . . .

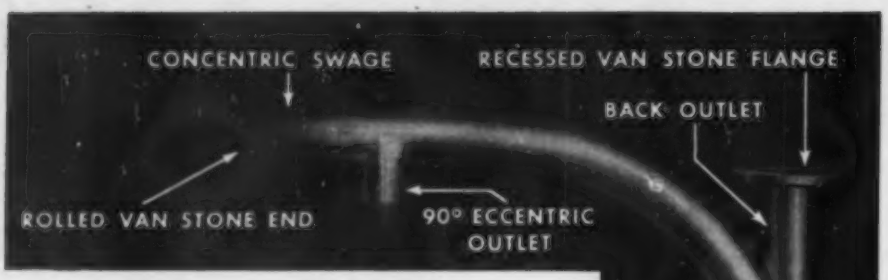
The Corhart Company maintains one of the largest and most competent research staffs in the refractories industry. If you have any problems connected with refractories we would like nothing better than to work with you.

Corhart Refractories Co., *Incorporated,*
16th and Lee Streets,
Louisville, 10, Kentucky.

*Trade Mark Registered

QUALITY ENDURANCE

CORHART
ELECTROCAST
REFRACTORIES



Stainless Steel Piping Engineered And Pre-Fabricated

Fifteen years ago, we pioneered in developing methods for welding and shop pre-fabrication of stainless steel piping for one of the world's largest food canning companies. We've gained much experience since, and today, we use the latest "inert-gas-shielded-arc" welding, which has only been available for commercial use since the war. The illustration gives some idea of "what-we-can-do" in stainless. Insides of welds and joints can be made absolutely smooth. Our experience in power and process piping dates back forty-eight years and today most utilities and large industrial plants know the perfection of our patented Westport Welded Joint and other high pressure, high temperature pipe engineering and pre-fabrication. Write us, or send us prints for an estimate.

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(PATENTED)
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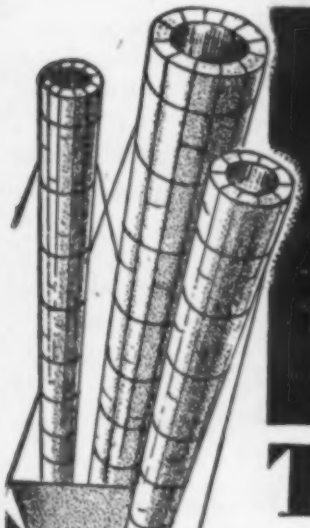
REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

MITCHELL
PIPING FABRICATORS AND CONTRACTORS



A WOOD *Naturally Resistant* TO ACIDS, ALKALIES AND DECAY

Tidewater RED CYPRESS

Tidewater Red Cypress serves better and lasts longer. It's natural resistance to acids, alkalies, etc. insures long and satisfactory results when used in vent stacks, pickling troughs, electroplating vats, etc. It's use under these conditions truly confirms its claim to being "The Wood Eternal".

If you have a particularly perplexing problem let us help you solve it. We invite inquiries concerning all types of tanks and vats . . . fully fabricated or partially fabricated.

The Real Cypress "The Wood Eternal"

FLEISHEL LUMBER COMPANY

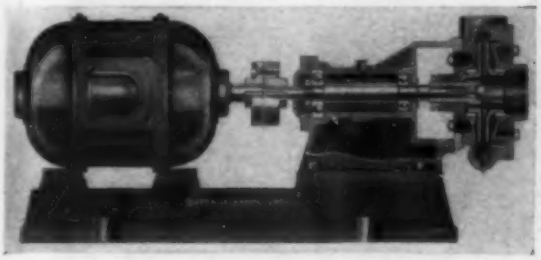
4232 Duncan Ave., St. Louis 19, Mo., NEwstead 2100

Continuous Soapmaking	Apr. 1947
Copra Refining	Feb. 1945
Cordite	Oct. 1943
Cyanamide	Apr. 1940
De-Inking Mill	Jan. 1948
Deodorizing Edible Oils	Sept. 1946
Delayed Coking	Feb. 1947
Diatomite	Aug. 1942
Ethyl Cellulose	Sept. 1945
Fatty Acid Distillation	Feb. 1948
Fatty Acids (separation)	Nov. 1946
Fertilizer (mixed)	July 1947
Fiber Glass Production	June 1947
Fluorspar (acid-grade)	Aug. 1945
Formaldehyde	Sept. 1942
Furfural Production	July 1945
Furfural Refining (lubricants)	Dec. 1940
Gasoline (aviation)	Dec. 1943
Glass (plate)	Jan. 1942
Glassine Paper	Nov. 1947
Glycerine (and red oil)	Sept. 1943
Glycerine and Soap	May 1942
Glycerine by Synthesis	Oct. 1948
Grain (continuous cooking)	Oct. 1944
Grain Alcohol	June 1945
Hydroabietyl Alcohol	Nov. 1948
Hydrogen	May 1946
Hydrogen Sulphide	Jan. 1940
Lactic Acid	June 1940
Leather (chrome)	Jan. 1943
Liquid Oxygen	Mar. 1947
Lubricants (dewaxing)	Oct. 1941
Lubricants (refining)	Dec. 1940
Magnesium (carbothermic)	June 1944
Magnesium Chemicals	Aug. 1947
Magnesium From Minerals	May 1944
Magnesium Metal (and $Ca(OCl)_2$)	Apr. 1945
Magnesium (sea water)	Nov. 1941
Mixed Fertilizer	July 1947
Molasses Distillation	May 1945
Monosodium Glutamate	Apr. 1948
Naval Stores	Mar. 1942
Neoprene	Jan. 1944
Nylon Production	Mar. 1946
Oils (deodorizing)	Sept. 1946
Oil (vegetable)	May 1947
Orange Products	Sept. 1944
Oxygen (liquid)	Mar. 1947
Paint	Mar. 1939
Paint and Varnish	Mar. 1945
Paper (cigarette)	June 1946
Paper (glassine)	Nov. 1947
Penicillin	Apr. 1944
Petrochemicals	July 1948
Phenol	Apr. 1939; Nov. 1940; Sept. 1947
Phenol Plastics	Mar. 1940
Phenolic Resin	Sept. 1939
Phosphates	May 1939
Phosphates (super)	Apr. 1943
Phthalic Anhydride	Aug. 1946
Porcelain	July 1939
Potassium Perchlorate	Dec. 1944
Powder (smokeless)	Apr. 1942
Pulp, Bleached Kraft	June 1948
Pulp (continuous bleaching)	Oct. 1947
Pulp (sulphate)	Nov. 1939
Pulp (sulphate bleaching)	Mar. 1944
Pulp (sulphite)	Aug. 1941
Rayon (staple fiber)	Aug. 1944
Rayon (viscose)	Jan. 1939; Oct. 1942
Rosin and Terpene Oils	Dec. 1947
Rubber (reclaim)	June 1941
Rubber Tire Production	May 1948
Salicylic Acid	Aug. 1943
Salt	Aug. 1940
Searles Lake Chemicals	Oct. 1945
Silica Aerogel	Feb. 1943
Soap	May 1942
Soapmaking (continuous)	Apr. 1947
Soda Ash and Caustic	Aug. 1948
Sodium Chlorate	Nov. 1944
Soybean Extraction	Sept. 1941
Stearic Acid	Sept. 1943
Stoneware (chemical)	Sept. 1940
Streptomycin	Oct. 1946
Strontium Chemicals	Jan. 1946
Styrene (Dow process)	Feb. 1944
Sugar (beet)	June 1942
Sugar (cane)	July 1941
Sugar (refining)	Feb. 1940
Sulphur (from coke-oven gas)	July 1944
Sulphur (mining)	Mar. 1941
Sulphuric Acid (sludge)	May 1941
Synthetic Ammonia	Dec. 1945
Synthetic Bead Catalyst	Apr. 1946
Tantalum	Sept. 1948
Terpene Oils (and rosin)	Dec. 1947
Varnish and Paint	Mar. 1945
Vegetable Oil	May 1947
Whiskey	Nov. 1942
White Lead	Mar. 1943
Zinc Oxide	Feb. 1941

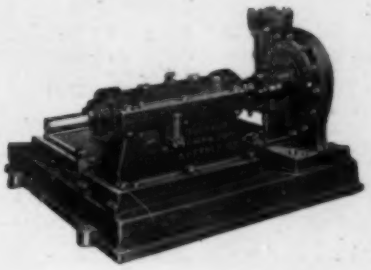
Best Results against SHOCK and CORROSION with "Buffalo" ACID PUMPS

All "Buffalo" Pumps are ruggedly constructed, to withstand the extra-hard usage often encountered under peak loads and against corrosive liquids. They can be made of non-brittle alloys which will stand heavy shock loads without breaking and give maximum resistance —when necessary—to corrosive action.

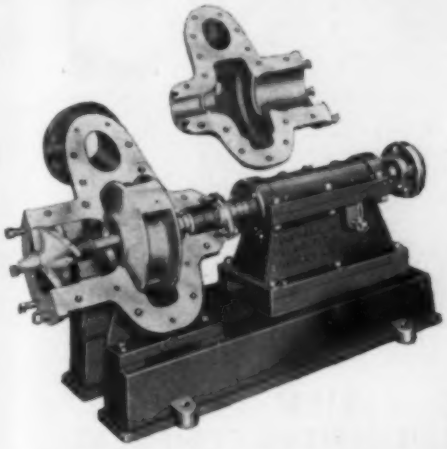
Here are four examples:



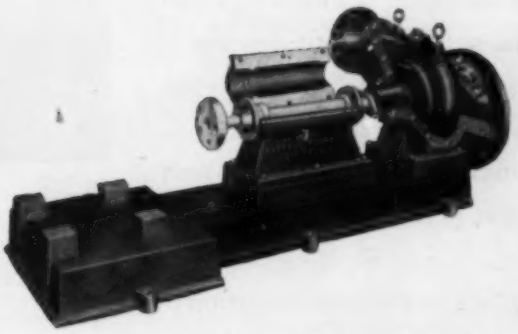
"CS" Single Suction, Full Ball Bearing—suitable for construction in iron, bronze, stainless steel, nickel, Hastelloy "B" and "C" and other machineable alloys, but not in all lead. Open impeller for handling viscuous liquids or large solids; enclosed impeller for other service.



Lead-Acid—for handling such chemicals as hot or cold sulphuric acids of all strengths, sulphurous acid, alum, ammonium sulphate and copper sulphate. Designed primarily for all-lead construction — also available all-iron and special-alloy, including aluminum.



Diagonally Split-Shell—specially designed for maintaining uniform flow in dealing with lumpy, hard-to-handle liquids. Upper half of casing removable, for accessibility in inspection and servicing.



Rubber-Lined Single Suction—for long-term use with chlorinated solutions, concentrated hydrochloric acid and other highly corrosive liquids—also solutions containing abrasive solids. All "exposed" internal parts covered with medium or hard rubber, according to type of service.

Write for full information on the complete line of "Buffalo" Pumps for chemical service—*Bulletin 982*

BUFFALO PUMPS, INC.

501 BROADWAY **BUFFALO, N. Y.**

Canada Pumps Ltd., Kitchener, Ont.

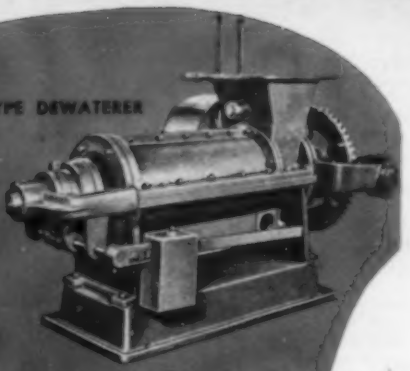
PUMPS by "Buffalo"

For

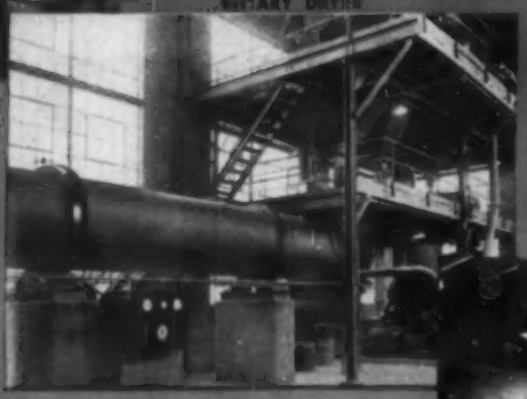
- WATER ANY TEMPERATURE
- PAPER STOCKS (NON-CLOGGING)
- GENERAL SERVICE
- ACIDS
- ALKALIS
- SLURRY
- CONDENSATE RETURN
- SUMP CLEARANCE
- FIRE SERVICE
- SEWAGE
- SELF-PRIMING SERVICE

RUGGED, PRECISION CONSTRUCTION—FOR LONG LIFE

DRUM DRYER



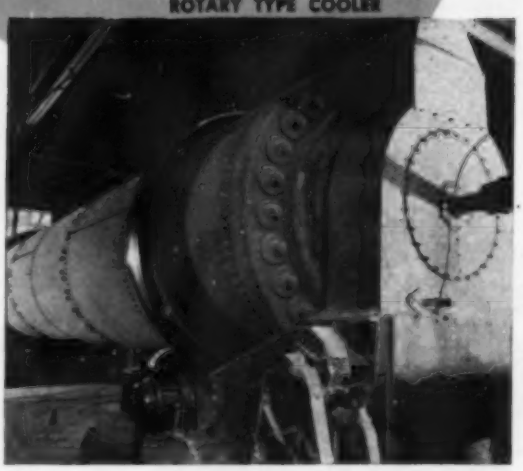
SCREW TYPE DEWATERER



ROTARY DRYER

CONTINUOUS THICKENING SCREENS

INTEGRATED EQUIPMENT IS MORE EFFICIENT



ROTARY TYPE COOLER

Processes involving drying, dewatering, cooling, etc. can, through proper integration of equipment, be made more profitable.

The knowledge and experience gained over a period of many years designing, fabricating and servicing various types of dryers, dewaterers, thickening screens, coolers, etc., for use in the chemical process industries, is incorporated in recommendations made by General American engineers.

In many instances, these recommendations have not only resulted in more efficient equipment performance but opened up new avenues of profits.

If you are contemplating a new plant, or the modernization of existing facilities, ask a General American engineer to assist you.

Other
GENERAL AMERICAN EQUIPMENT

EVAPORATORS	TOWERS	TURBO-MIXERS
THICKENERS	TANKS	FILTERS
DEWATERERS	BINS	KILNS

GENERAL AMERICAN TRANSPORTATION CORPORATION

Process Equipment Division

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WORKS: Sharon, Pa., East Chicago, Ind.

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PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

NEWS FROM ABROAD

Special Correspondence

McGRAW-HILL *World News*

Big boost in British chemical output will occur when this huge Petrocarbon plant is completed at Partington, England. More than 100 chemicals will be produced at the 120-acre unit. Part of the plant is shown here.

Second World Technical Congress To Meet in Cairo

LONDON — The second International Technical Congress, sponsored by the World Engineering Conference, will take place at the invitation of the Egyptian government in Cairo, March 20-26, 1949.

The first such Congress was held in Paris in September 1946 and was attended by approximately 1,200 engineers from 30 countries. It was this first Congress that gave rise to the permanent organization of the WEC, with its several national committees presently engaged in the process of securing affiliation of the societies of engineers and technicians in their respective countries.

The Conference has just recently been granted "Consultative Status" by UNESCO—which entitles the WEC to send observers to UNESCO's General Conference and which may lead to the WEC being invited to participate in conferences of experts and in advisory committees set up by UNESCO on technical subjects.

Theme of the second Congress in Cairo will be "Raw Materials as an Industrial and Social Problem." An important related problem, of especial interest to members from countries ringing the Mediterranean, will be discussed in one of the sections, devoted to "The Problem of Water in the Middle East."

Detailed agenda and membership applications can be obtained from the Cairo Congress Secretariat (the Egyptian National Committee of the WEC), 3 Rue Bachler, Cairo; the International Secretariat of the WEC, 77 Avenue Raymond-Poincare, Paris 16; or from the nearest national committee. In London, the British Committee is at 82 Victoria St., S.W. 1; in the U. S., Stewart Ricmal is secretary of the American International Relations Committee for the WEC, at 29 West 39th St., New York.

Standard of Jersey Studies Weed Killing in Venezuela

CARACAS—H. F. Pierce, U. S. entomologist, has completed a study of the effectiveness of insecticides and weed-killers being tried out in Venezuela. Mr. Pierce, who works for the Standard Oil Co. (N. J.), said that the new insect and weed-killing formulas may be developed by his company to aid Venezuelan farmers.

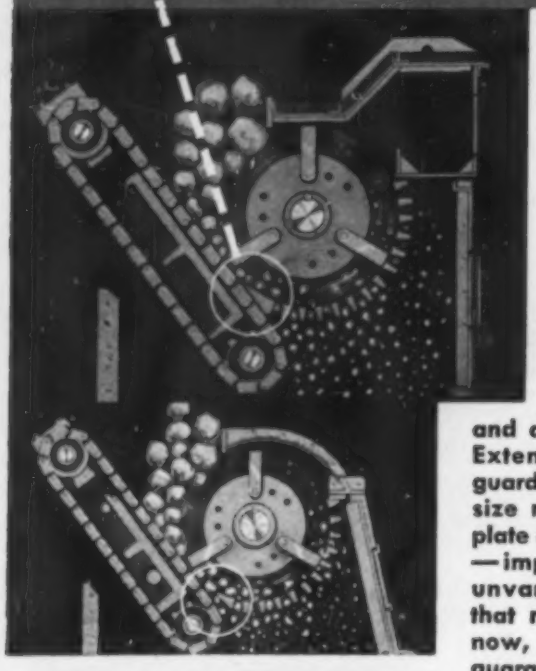
He reported that the insecticides and weed-killers made from petroleum byproducts are playing an important role in the development of agriculture in Venezuela. At a farm organized by a subsidiary of Nelson Rockefeller's International Basic Economy Corp., —Venezuelan Basic Economy Corp. Mr. Pierce saw Varsol, a petroleum byproduct, being used successfully to kill weeds among root vegetables like carrots. Varsol, a product made and marketed by Creole Petroleum Corp. —a Standard Oil subsidiary—in Venezuela, does not damage carrots themselves, but does rapidly destroy weeds which infest a carrot patch. Varsol is known to most people as a solvent used in drycleaning and also as a paint thinner.

After his inspection trip to Venezuela, Mr. Pierce will continue on to other South American countries where he will conduct similar on-the-spot studies. His report to Standard Oil laboratories in the U. S. will be used as the basis for further research. In view of the fact that these insect and weed killers do not always prove successful elsewhere in the world, experts like Mr. Pierce are sent into the field to gather exact data on local problems.

New Superphosphate Plant For New Zealand

WELLINGTON—French North African interests are pushing the establishment of a phosphate grinding mill in New Zealand. Because of the destruc-

BETTER CRUSHING BEGINS HERE!



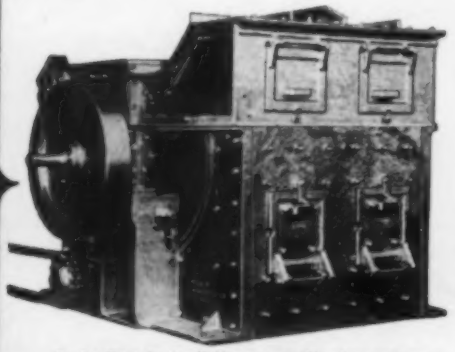
Crushing money is saved or squandered in the "heart" of the mill...where reduction begins! That's why the headline feature of the new improved "36 Series" Dixie Hammermill is the extension of Dixie's Continuously Moving Breaker Plate*... a unique, money-saving innovation that sets a new standard of crushing efficiency.

Note by comparing before and after diagrams how the new, Extended Moving Breaker Plate guards against the passage of oversize material between the breaker plate and front cage bar. The result —improved grinding control for unvarying uniformity of product that makes the Dixie Hammermill now, more than ever before, your guarantee of greater production at less cost.

NEW! IMPROVED!
DIXIE HAMMERMILL

Other important changes in the new "36 Series" Dixie Hammermill include:

- 1. All-steel construction for greater strength . . . longer life
- 2. Flange type end discs of all cast steel for protection of hammer bolts and nuts from wear at ends
- 3. Convenient clean-out and inspection door
- 4. Metal trap (optional) for facilitating removal of tramp iron.



Dixie "36 Series" Hammermills, for primary or secondary crushing, are built in 4 sizes in capacities ranging from 25 to 150 tons.

*U. S. Patents Granted and Pending

DIXIE
MACHINERY MFG. CO.

MAIN OFFICE & PLANT
4172 GOODFELLOW AVE., ST. LOUIS 20, MO.
FOREIGN OFFICE: 104 PEARL ST., NEW YORK, N.Y.

WRITE TODAY FOR COMPLETE DETAILS!

tion of handling facilities at Nauru during the war, the dominion has lately been depending largely on phosphate rock from French Oceania and even North Africa.

Nauru was the only major British-controlled phosphate source in the Pacific. Australia and New Zealand recently acquired joint control in the Christmas Island phosphate workings, 200 mi. south of Java. (Not to be confused with the island of the same name in the Pacific.) The nine superphosphate plants in the Dominion have also been substituting native serpentine rock for imported phosphate of lime.

With supplies of phosphate rock assured, the dominion government has approved the establishment of a new superphosphate plant at Napier. Its capacity of 100,000 tons a year will increase New Zealand's fertilizer capacity by 20 percent.

Resin Lining Activities Expanded by Canadian Firm

VANCOUVER—Industrial Coatings Ltd. is steadily developing its operations in British Columbia. The firm is headed by F. R. Killam and has its headquarters at Vancouver.

It was founded in 1946 and under Mr. Killam's direction has pioneered the process of applying resinous coatings in western Canada.

The coatings, made from phenol-formaldehyde resins, are applied to metals after treatment of the surface by steel-grit blastings. For most jobs, six coatings, and from four to six bakings in a drying room, are applied.

Typical of the major projects handled by Industrial Coatings Ltd. this year was the job of lining 10 huge beer fermenters for Vancouver Breweries Ltd. Breweries generally are replacing wooden vats with lined metal containers, said Mr. Killam.

Another big job completed recently was the lining of the "stock inlet" (or headbox) of Powell River Co.'s big new paper machine, which entered operation last month.

Perhaps the most revolutionary process undertaken by the firm is the lining of bread pans with a silicone coating, dispensing with the need for fat to grease the pan. This method of baking is currently being used by at least one large bread bakery concern. Raw resins are imported.

Melbourne and Sydney to Get Huge Glass Furnaces

MELBOURNE — Australian Consolidated Industries Ltd. is building two new glass furnaces, in Sydney and Mel-

by engineers for engineers

ENGINEERS design and supervise every step in the manufacture of WeldELLS and Taylor Forge Flanges to meet the most exacting requirements of the most exacting customer.

Taylor Forge engineers have spent a good many years meeting special needs for unusual piping installations around the world and in every basic industrial field.

This is an important reason why engineers in thousands of companies turn to Taylor Forge when their problems are tough.

It is an important reason for *you* to turn to Taylor Forge for the finest welding fittings and flanges.

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Make the layout justify the outlay

Whatever your piping problem, "Corrosion Service Piping" will help you do a better job. Write for your copy.

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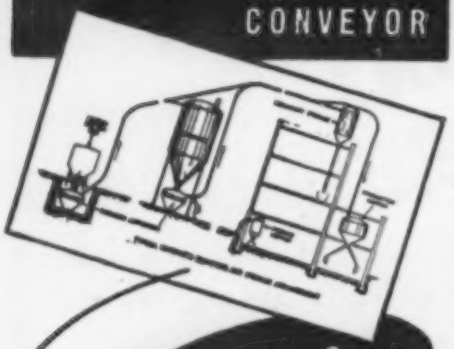

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bourne, whose 150-ton-a-day capacity will exceed, it is claimed, the capacity of any other glass plant in the world. They will produce glass containers of every description.

ACI started production in Singapore recently and has placed equipment orders in the U.S. to set up a crockery plant in Australia. The firm also obtained Australian rights to an American process for manufacturing glazed wall tiles. This undertaking is expected to swing into production shortly.

Multi-Million Dollar Investment Program for Chemical Expansion in Great Britain Is Under Way

LONDON — Government approval has been given for an extensive program of capital expenditure for the construction, enlargement, replacement and modernization of chemical plants involving a total sum of well over $800,000,000 by 1952. This figure includes new plants already nearing completion as well as building plans which have not yet been put into effect. When all new plants are working, Britain will be self-supporting, with few exceptions, in the main items of chemical production and have a susbtantially increased margin for export of such articles as alkalis, dyestuffs and phosphatic products; moreover, she will be able to reduce the dependence of other European countries on dollar imports.

Surveying recent and anticipated progress in the British chemical industry, the President of the Board of Trade singled out ardil (the new synthetic fiber to be made from groundnut shells), terylene, polythene and synthetic detergents among new materials and mentioned alkalis, synthetic fibers, fertilizers, plastics, dyestuffs and carbon black. He said production of these chemicals is to be raised further in the British Isles. He also referred specifically to several major projects for cracking oil for chemicals, linked with the planned expansion of the country's petroleum refining capacity.

The major proportion of the $800,000,000 will be expended on new plant for organic chemicals, including dyestuffs, plastics, detergents, solvents, insecticides, etc., but in the earlier part of the four year period the additions to the output capacity for alkalis, fertilizers and other organic chemicals will be important. This

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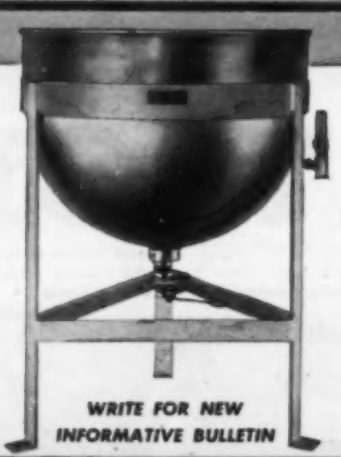

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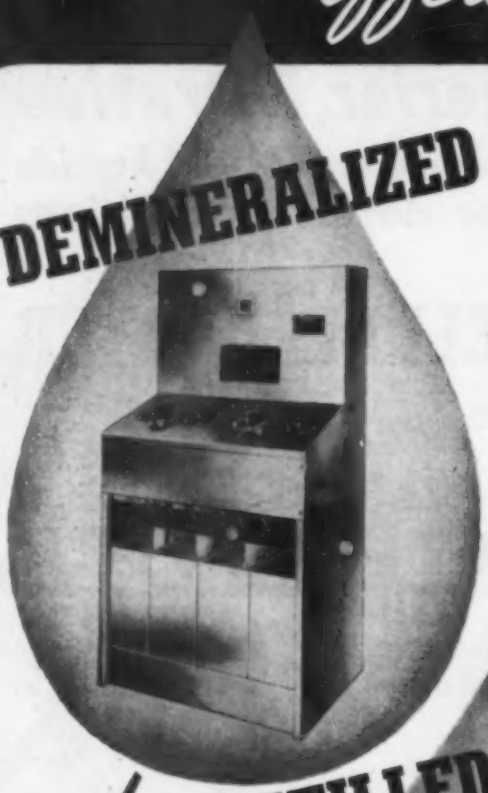

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extra capacity will indeed be urgently needed to meet growing home requirements and leave a sufficient surplus for meeting the increased export target for next year.

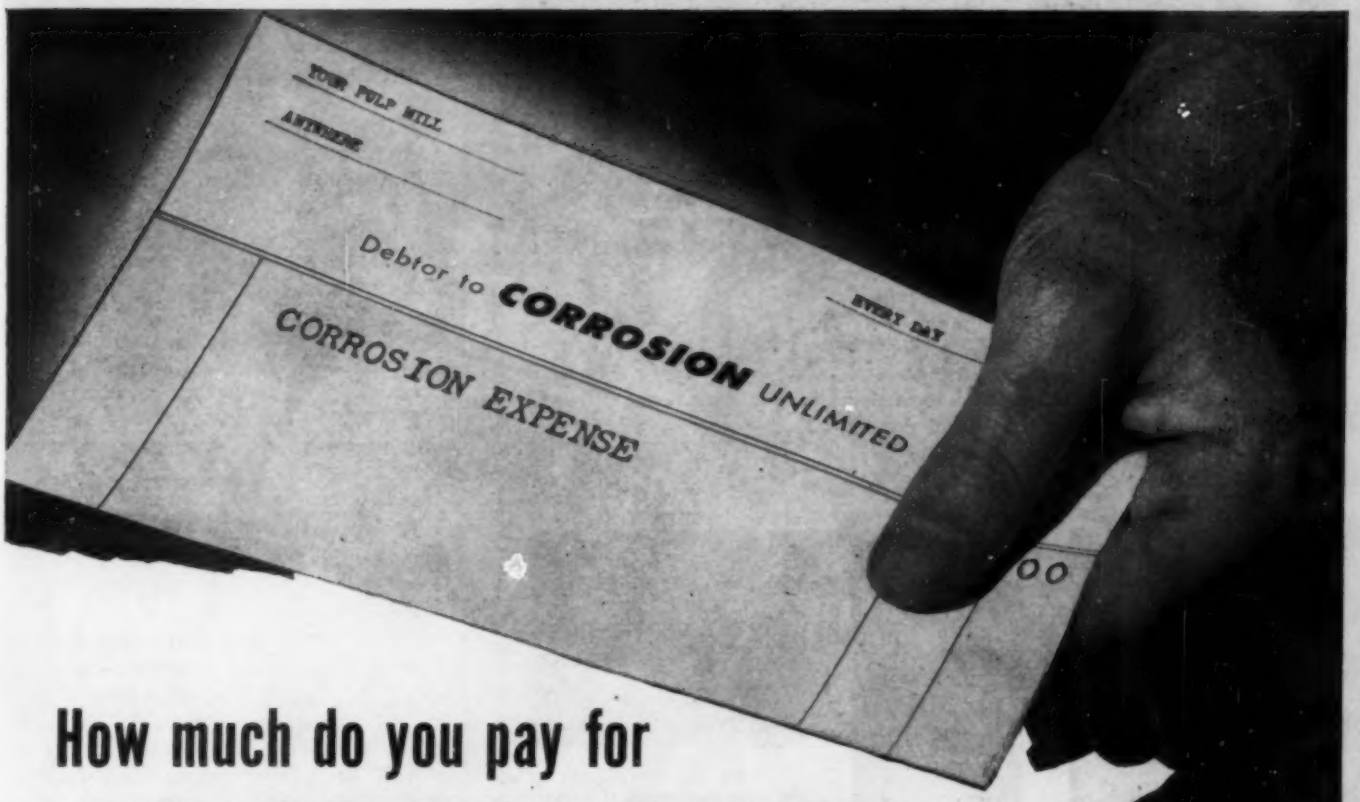
Chemical exports which in September were slightly above $30,000,000 are expected to reach the export target of $32,200,000 at the end of this year. The government's new export target for the chemical industry stands at $36,000,000 for the end of 1949. This monthly figure compares with actual exports in the whole of 1947 of $268,000,000. In that year the total of chemical products sold in the British home market or exported is estimated to have been $933,000,000, including small amounts of imported chemicals. These figures give an idea of the importance of the export market to British chemical manufacturers and the great exertions needed to release more chemicals for exportation.

It is widely agreed that any further increase in chemical exports can only be the concomitant of a further rise in chemical production. As chemical plants are generally now working to capacity, further output and further exports can be expected only from new plants whether the new export target and the growing needs of the home market can be met according to the official time-table depends on the speed with which new chemical factories and installations are put into commission. Building licenses are now being granted to chemical manufacturers over a wider field, and the chemical industry's share in new industrial building is stated to be larger than that of any other industry. This also appears from the figure of proposed capital expenditure over the next four years.

Carbon Black Industry

As the opportunities for further export gains are gradually diminishing, more attention is now being devoted in British official quarters to means of saving foreign currency for imports. The plans for the establishment of a British carbon black industry progressed further last month with the approval of a third manufacturing project, also in cooperation with a U. S. company—Godfrey L. Cabot, Inc., of Boston, Mass.—which is to be completed in two years and together with the two projects announced earlier may raise the British output of carbon black to the present level of requirements.

All British needs of barium chloride will also be met locally, from the end of this year onwards, as a result of the opening of a new factory by Laporte Chemicals Ltd. at Barnsley. The temporary shortage of barium chloride which has been felt severely since the



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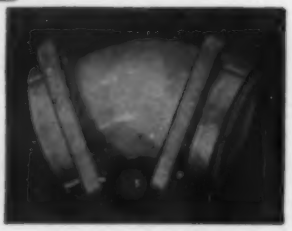

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Both vertical and angle check valves are porcelain to porcelain with no metal in contact with material being handled. Friction loss extremely low because ample space provided for flow around ball. Valve seat ground and polished to very close tolerances — ball is a polished sphere.

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closing down of the department concerned by Athole G. Allen Co. will thus be ended, as there are sufficient resources of mineral barytes in various parts of the country. At first barium chloride from the new plant will be available only in the crystal form, but later an anhydrous quality will be produced .

The production of magnesia from sea water will be raised by 50 percent to 40,000 long tons a year in the Palliser works of British Periclase Co. at Hartlepool which was the first plant of its kind in the world when built in 1937. More magnesia is needed in connection with the production of refractory bricks required for the construction of furnaces for the steel industry. The increased demand for refractory materials puts British production of these to a severe test at present.

Bakelite

Production capacity for Bakelite molding powder in Britain has been increased by 25 percent with the opening of the phenolic molding powder unit at the $8,000,000 plant which Bakelite Ltd. is erecting at Aycliffe, near Darlington. Other sections of the plant will be devoted to the production of Vybak vinyl resin thermoplastic materials, to be produced as compounds for calendering into sheet, as extrusion compounds and as compounds for covering electric wires and cables. For the first time the whole series of operations is carried out automatically in the Aycliffe plant.

Considerable additional capacity for making chemicals needed in the rayon industry will be needed under the four year plans submitted to the Organization for European Economic Cooperation by the British government. These provide for a doubling of the country's rayon output. The production of filament yarn is now 25 percent above the prewar level, and that of rayon staple has increased by more than 100 percent. Any further increase in rayon production will therefore heavily tax the capacity of chemicals suppliers. Some of the rayon producers are making their own production arrangements for the chemicals they need, also in connection with the manufacture of cellulose acetate, photographic film base, and plastics, but the progress of these has been retarded by delivery delays.

One of the many private schemes for the utilization of indigenous raw material resources for chemical purposes has had to be postponed. British Lignite Products Ltd. has adjourned the decision on erection of a montan wax plant until the briquetting plant which was set up this year has proved its commercial value over a reasonable

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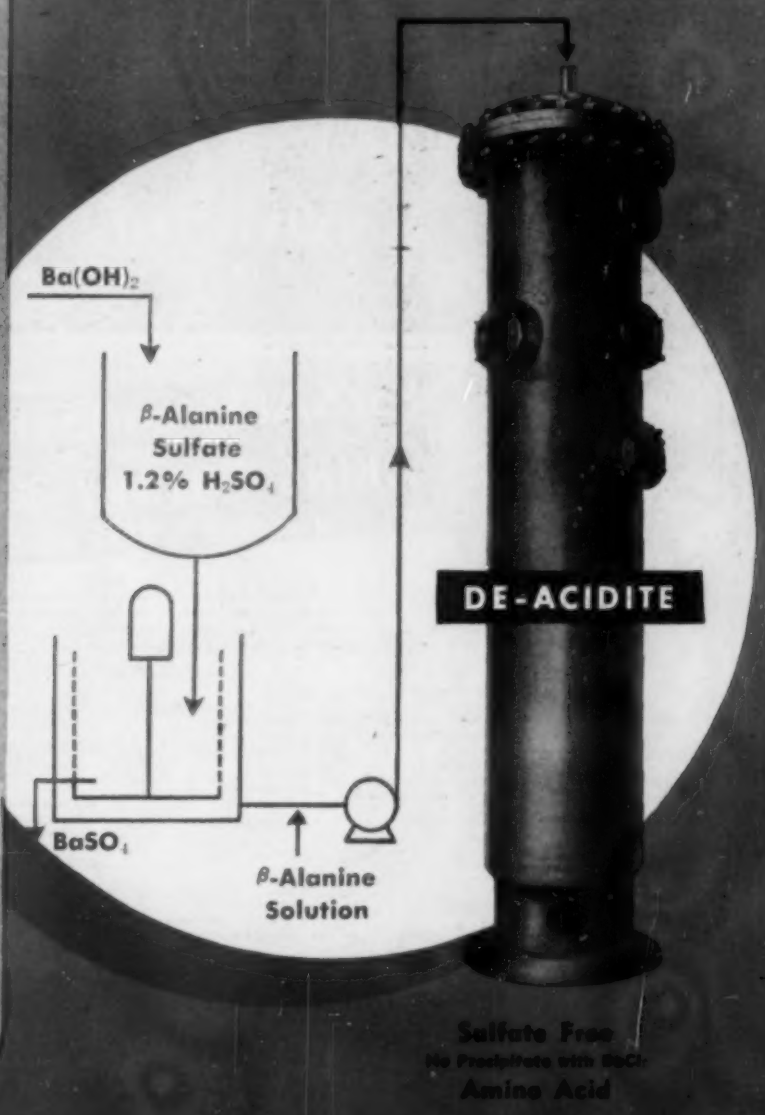

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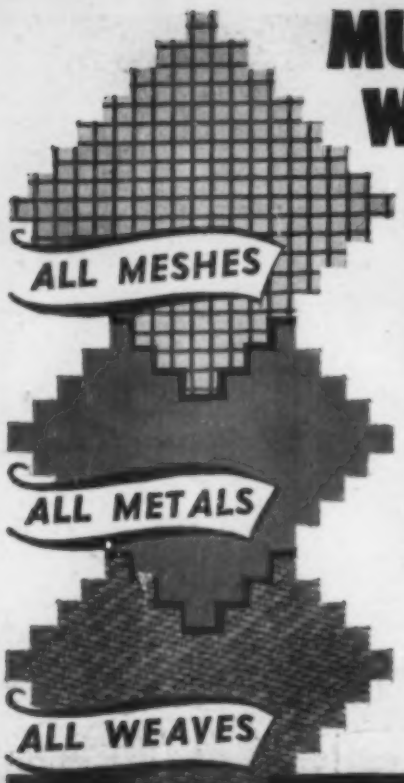

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period. This briquetting plant is almost in operation and will be capable of full production by the end of this year. Of the various public schemes for chemical utilization of indigenous substances, on the other hand, at least one is to be extended. The herring oil reduction plants at Lerwick, Fraserburgh, Wick and Stornoway are to remain open throughout the English fishing season, and there are plans in hand for the erection of oil reduction plant at Yarmouth.

The nationalization of the British steel industry will add to the government's chemical commitments. Some of the iron and steel companies to be taken over in 1950 have extensive chemical interests. Tar products, refractories, basic slag, coke-oven by-products, soap and other substances are being produced in small quantities by various subsidiaries and branches of steel producers, and while these chemical interests are individually small, they will in the aggregate present the authorities with a difficult problem because they are small and cannot be run on the centralized and necessarily bureaucratic lines of big basic industries under the control of public boards. Most of these new chemical undertakings to be placed under state ownership are similar in character and kind of output to the byproduct plants taken over with the nationalized coke-oven and gasworks industries. They may for this reason be put under the same administration. But others will force the authorities to venture into entirely new fields unless, as some observers believe, these chemical interests are transferred back to private ownership.

France and Hawaii Get Fertilizer From Trail

TRAIL—Nine thousand tons of fertilizer from Trail was recently loaded at Pacific Coast Terminals, New Westminster, B. C., for France. This is the first full shipload of fertilizer to be forwarded this year. A further 4,500 tons of fertilizer from the Trail plants of the Consolidated Mining & Smelting Co. has just been shipped to Hawaii.

Australian Patent Requested On Cellulose Esters

A RECENT patent application by The Colonial Sugar Refining Co. Ltd. proposes a new method of producing cellulose esters, for practical purposes presumably cellulose acetate. The cellulose material is treated with an acid anhydride in the presence of a catalyst. This treatment is carried out

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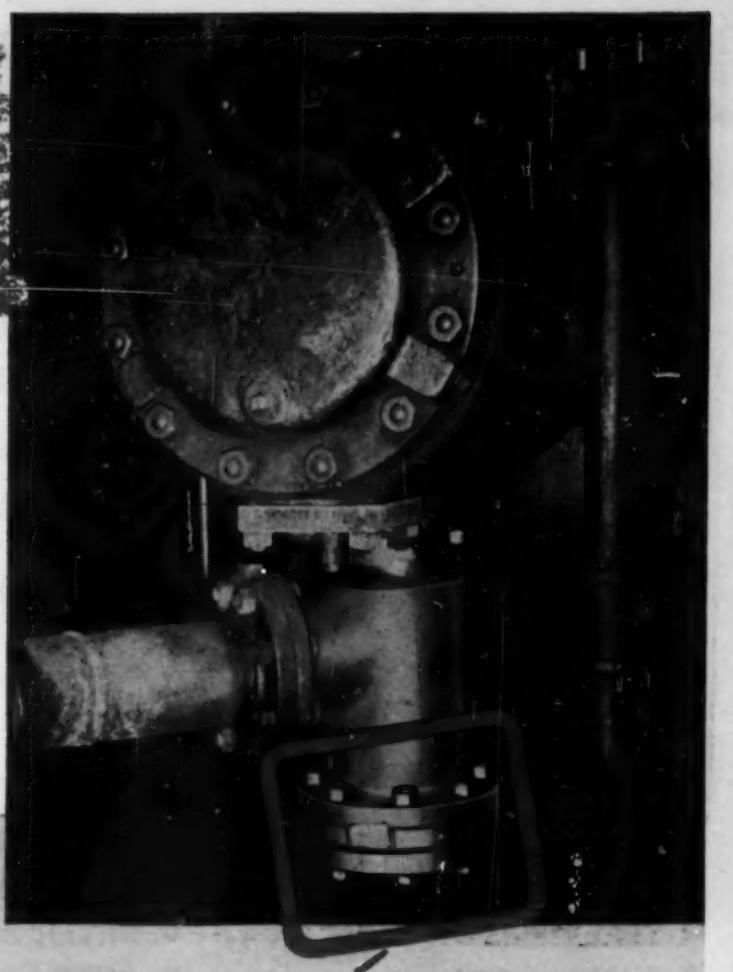

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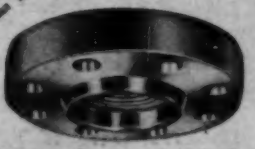

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at the boiling point of the reaction mixture, and the pressure on the mixture is adjusted in such a manner that excessive degradation of the cellulose is prevented. The CSR is known to be planning production of cellulose acetate plastics on a large scale.

Canadians Discuss New Chemurgy Developments

VANCOUVER—Natural apple juice developed at the Dominion Experimental laboratory at Summerland, B. C., will be produced this coming season by a large British Columbia processing plant. W. D. McFarlane, Toronto chemist, speaking at an agricultural session of the Canadian Chamber of Commerce convention in Vancouver, referred to this product as one of the new chemurgic developments in Canada. He said the B. C. plant would this year produce 100,000 cases of the new natural apple juice.

The Summerland laboratory also has a pilot plant in operation for the extraction of apple "ester" used as flavoring in the baking and candy industry, he reported.

Produced also in B. C., he said, is a light-colored, acid-free, concentrated apple juice, similar to the apple-honey sold in United States.

Production of oil seeds for processing in Canada has "great prospects for expansion and sound economic developments," Dr. McFarlane continued.

He saw possibility for vast expansion of soybean acreage for oil, and a pressing need for an intensified sunflower-breeding program to get a higher yield of seed and oil, to lessen Canada's dependence on the tropics for vegetable fats.

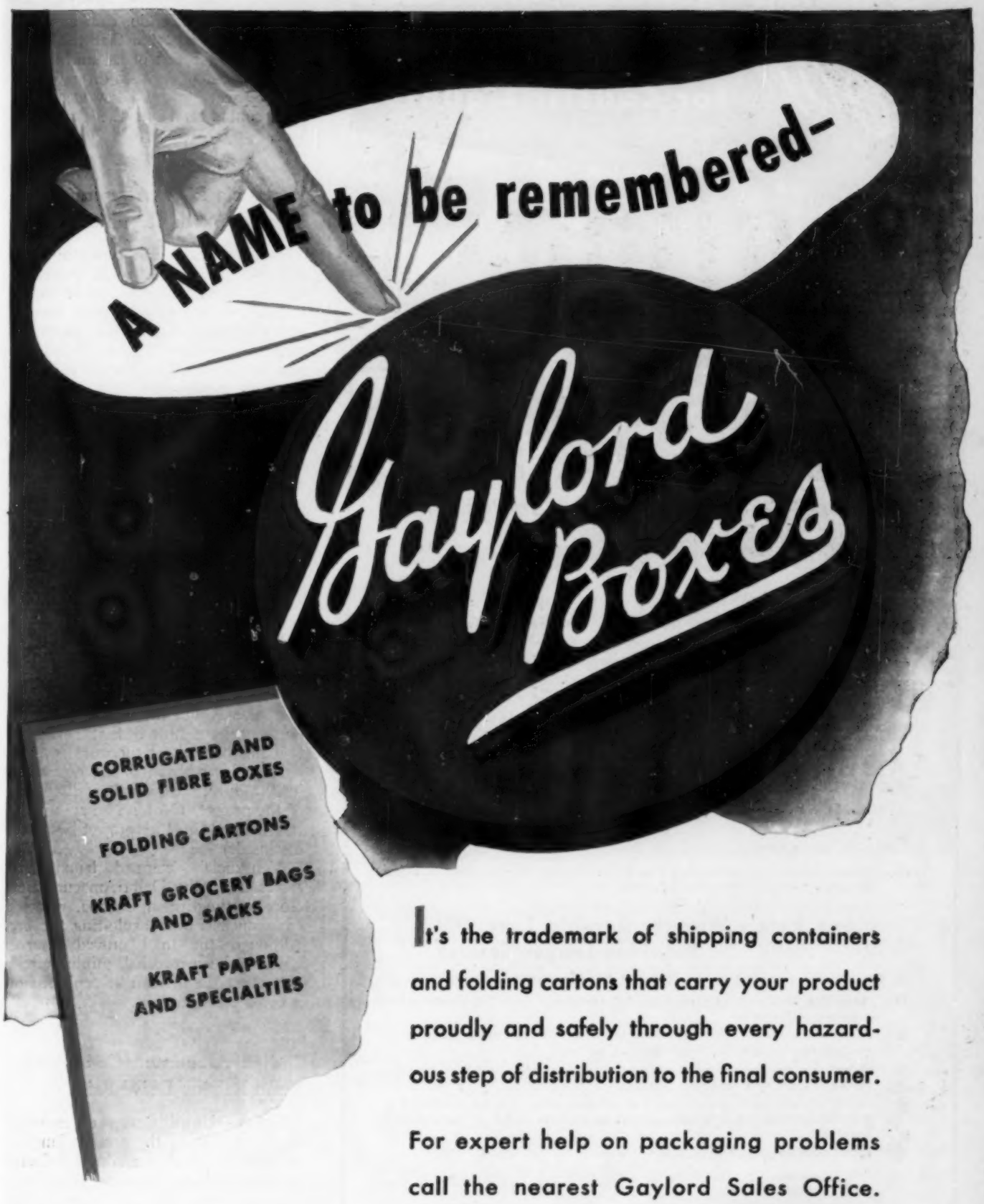
Donald G. McKenzie, chairman, Board of Grain Commissioners, warned the meeting that any large surpluses of farm products in the next few years would have a "disastrous" effect on the Canadian economy.

Since 1936 the Chamber has had a committee on chemurgy, which is the industrial utilization of farm products.

India Builds Large Glass Plant at Asansol

CALCUTTA—Construction of what is described as the "largest glass factory in the East" is under way at Asanol, industrial center near here, for the Hindustan Development Corp. Ltd. —a private company headed by N. R. Sarkar, former Commerce minister.

Work is being directed by John I. Strevens, chief technical adviser to the



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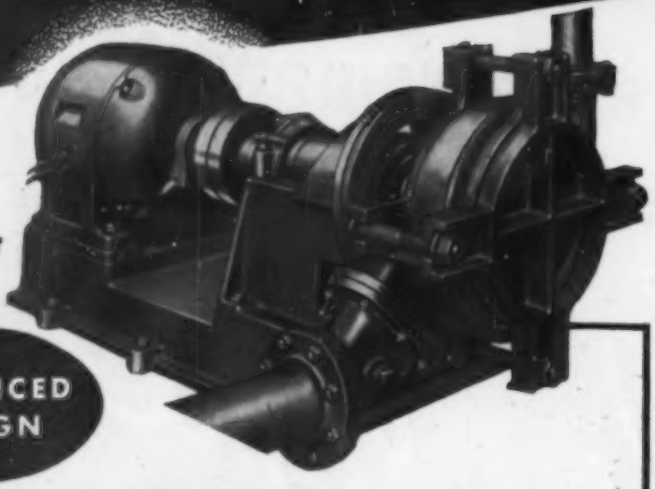

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In most of the largest mills Morris liquor pumps are considered *the* standard—and have been so regarded for several decades. Now Morris continues to maintain its leadership with the durable Type "R"—especially engineered to handle black, green and white liquors, as well as any liquid containing abrasive solids and chemicals in suspension. . . . with less wear, less maintenance and lower operating costs.

Here's Why the Durable Type "R" Is Easier to Install and Maintain

1. Shell is interchangeable for left- or right-hand rotation.
2. Suction and discharge nozzles can swivel to any of 72 different positions.
3. Impeller can be removed without disturbing the suction and discharge piping or the bearings.
4. Worn clearances on the suction side of the impeller can be closed *in a few minutes* simply by turning four adjusting screws.

And Here's Why the Durable Type "R" Provides Longer Service

- Heavier wear-resisting parts — designed for exceptionally long life.
- No internal studs or bolts — caustic liquors cannot seep past threads and cause maintenance headaches.
- Low pressure stuffing box — since the gland is under suction pressure only, most packing troubles are eliminated.
- Suction disc liner — to minimize wear, an extra-heavy liner is provided between the suction disc and impeller.
- Interchangeable parts — pump parts of different alloys may be substituted to compensate for changes in the corrosive or abrasive action of the materials handled.
- Fewer wearing parts.

There is a Morris Pump particularly suited to your requirements. Send today for FREE specifications and operational data.

MORRIS CENTRIFUGAL PUMPS

MORRIS MACHINE WORKS
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Consolidated Glass Co. Ltd. of Great Britain. He has stated that the plant also will be the first of its kind in the East to manufacture such diverse products as sheet glass, window glass, and glass containers from the same furnace.

Venezuela Plans Aluminum Industry With Reynolds

CARACAS—Venezuelan government is studying the possibility of installing an aluminum reduction plant in its territory, taking advantage of the reserves of bauxite and the enormous quantities of natural gas in its subsoil, now being wasted by the oil industry. To study this project, R. S. Reynolds, president of Reynolds Metals Co., recently visited the country and studied on the spot the possibility of carrying out the plans. He visited the oil fields in western and eastern Venezuela.

Mr. Reynolds was invited by the Venezuelan Development Corp.—a government agency in charge of the development of national economy with an initial capital of $30,000,000, —and stayed over two weeks discussing the plans. He submitted his report to the Venezuelan government and although his findings have not been officially disclosed, sources close to Reynolds and the Venezuelan government have hinted that Reynold's visit has been most successful.

Reynolds will visit Venezuela again in the future for further discussion of the project. (Note: The amount to be invested in the project was not disclosed.)

Venezuela's mapped bauxite reserves are in the Delta Amacuro area, close to the British Guiana, where a company has been exploiting the ore. Although the total proved reserves have not been revealed, mining circles agree that the ore can be exploited on a commercial basis.

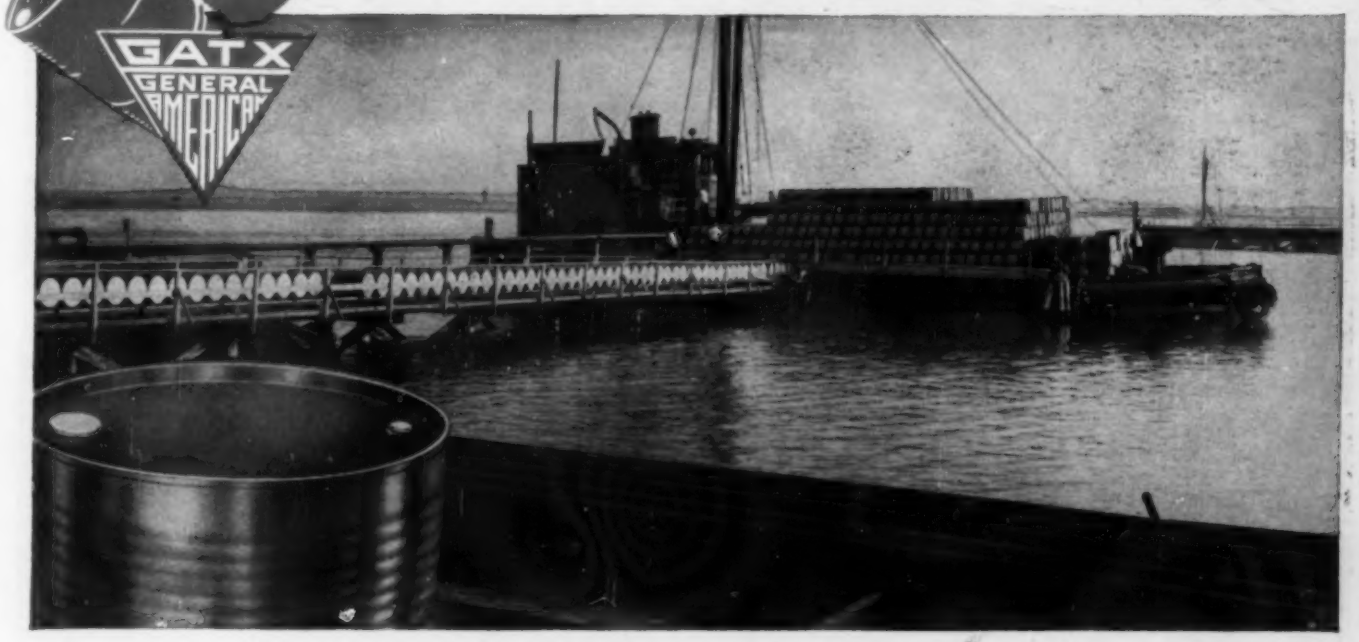
Indian Aluminum Company's Fund Raising Drive Fails

BOMBAY—Unwillingness of investors to risk money at the present juncture of Indian economic affairs is reflected in failure of the National Aluminum Co. of India Ltd. to raise enough funds to carry out its projected Central India works.

Nevertheless, the Central Provinces government has indicated it has faith enough in the project to carry it out on its own initiative as a provincial enterprise. Meanwhile, stock payments by would-be investors are being returned.

GENERAL AMERICAN assures shippers *safe* storage—and *safe* deliveries

—in drums equipped with Tri-Sure Closures



The General American Transportation Corporation is one of the world's largest distributing and storage systems for liquids. It can store and ship any kind of liquid — in any quantity. And it can give every gallon — in tanks, cars or drums — the privacy, skill and *protection* which fine liquids need.

Foremost among its facilities for protection are the Tri-Sure Closures* which General American keeps ready at all its filling plants — to safeguard products in drums from tampering, leakage and seepage.

For, when customers specify "Tri-Sure Closures," their products are given the protection of an inter-engaging *flange, plug* and *seal* which provide an *extra* margin of safety from leakage and seepage . . . from internal and external pressure . . . from breathing-in and contamination . . . from pilferage and substitution.

Whether you use a private or public distributing system, take the precaution which most shippers consider essential for the safety of fuel and chemicals: *when you order drums, or the shipment of your product in drums, always specify "Tri-Sure Closures."*

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*The Tri-Sure Trademark is a mark of reliability backed by 26 years serving industry. It tells your customers that genuine Tri-Sure flanges (inserted with genuine Tri-Sure dies), plugs and seals have been used.

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Hydrochloric Acid versus Construction Materials

Part I of a symposium in which a representative group of construction materials are evaluated for services involving hydrochloric acid.

STAINLESS STEEL

W. G. RENSHAW
Allegheny Ludlum Steel Corp.
Brackenridge, Pa.

THE STAINLESS steels, like most other metals, are usually rapidly attacked by hydrochloric acid and its solutions. In many other chemical solutions and under many other conditions, stainless steels offer excellent service due to the existence of a protective or passive film on the surface of the metal which is easily maintained where conditions are of an oxidizing nature. But in the case of hydrochloric acid very strongly reducing conditions are encountered regardless of the acid concentration and these are capable of destroying the protective film, thus allowing the acid to attack the metal.

For this reason, the stainless steels ordinarily are not recommended for any hydrochloric acid solutions, even at room temperatures. The addition of molybdenum to the 18-8 stainless steel composition does lower the solubility rate in hydrochloric acid somewhat but not sufficiently to warrant the use of this alloy for such applications.

Although not directly considered as hydrochloric acid solutions, experience has shown that certain chlorides, such as magnesium or calcium chloride, upon long standing undisturbed tend to hydrolyze slightly to an acid condition where minute amounts of hydrochloric acid would be present. Under such circumstances, pitting can occur with Type 304. Type 316, because of its better corrosion resistance, is usually more suitable than Type 304 for such applications.

Unlike the case of sulphuric acid, the addition of salts or other compounds to hydrochloric acid solutions does not inhibit attack on the stainless steels to any appreciable extent whereby the stainless steels could be employed.

LEAD

KEMPTON H. ROLL
Lead Industries Assn., New York

HYDROCHLORIC acid is an example of a corrosive with which the use of lead is possible under certain conditions but is not generally recommended. It has been used with some corrosion in concentrations up to 30 percent at normal temperatures and 20 percent at 100 deg. C. Strong, concentrated acid can be used cautiously with either chemical or antimonial lead at room temperature. Of course, the attack on lead by any corrosive chemical increases with the agitation to which the solution is subjected.

Purity of the acid also influences the degree to which it will attack lead. The presence of water in hydrochloric acid causes corrosion by forming a slightly soluble lead chloride corrosion product. Anhydrous HCl is occasionally handled by lead. Gaseous HCl, a byproduct of some chlorination processes, has been and is being handled successfully in lead equipment. Certain impurities in the acid solution also influence its effect on lead. For example, commercial acid containing 0.5 to 0.8 percent chlorine may double the corrosion of lead over that of the pure acid and the presence of 1 percent iron chloride may increase corrosion as much as five times.

The addition of Quinoidine as a corrosion restrainer has been used effectively with hydrochloric acid and lead but it is not effective enough to permit lead to be used without fear of reaction with the acid.

RUBBER LINING

O. S. TRUE
U. S. Rubber Co.
New York, N. Y.

RUBBER is an excellent protective medium against corrosion from hydrochloric acid. Wooden tanks lined with unvulcanized pure gum natural rubber sheets were first used over 40 years ago for the storage of concentrated hydrochloric acid. Some of this original equipment is still in service. Due to disadvantages of wooden tanks however, rubber lined steel tanks have been used almost exclusively for the last 25 years.

Soft natural rubber compounds have been extensively used during this time as linings for storage tanks to hold concentrated acid at temperatures up to 140 deg. F. They are also satisfactory for lining byproduct acid and waste acid storage tanks. Some outdoor installations of this type run into extremely large sizes. Storage tanks rubber lined in the field, in sizes up to 40 ft. in diameter by 48 ft. high are in service for the storage of byproduct 32 percent hydrochloric. Concentrated or dilute hydrochloric acid may be conveniently and safely transported in soft rubber lined tank cars or trucks.

The chemical resistance of natural rubber is increased by a film of rubber hydrochloride that forms on the lining surface when it is first exposed to hydrochloric acid. This film is very inert and acts as a protective coating over the entire lining and prevents further penetration of acid.

Semi-hard natural rubber compounds are used for lining pipe and fittings, reaction vessels and other equipment for concentrated acid up to 160 deg. F. Special flexible ebonite linings will handle concentrated acid

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PHOSPHORUS (Yellow or White)	PHOSPHORIC ANHYDRIDE
PHOSPHORUS OXYCHLORIDE	PHOSPHORIC ACID
PHOSPHORUS TRICHLORIDE	SODIUM CHLORATE
PHOSPHORUS PENTACHLORIDE	POTASSIUM CHLORATE
PHOSPHORUS PENTASULFIDE	POTASSIUM PERCHLORATE
PHOSPHORUS SESQUISULPHIDE	HYPOPHOSPHITES
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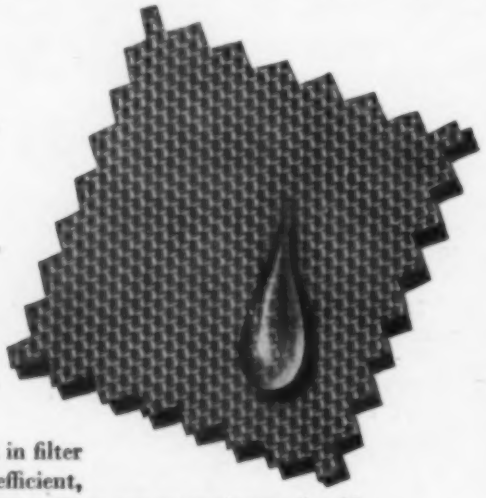

the right filter base

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SPERRY
FILTER BASES

as high as 180 deg. F. This material has been used for 20 percent concentrations up to 220 deg. F.

In installations where aliphatic hydrocarbons or mineral oils are present as contaminants in hydrochloric acid, neoprene makes an excellent lining. Perbunan and Hycar are suitable for services involving contact with animal and vegetable oils as well as aliphatic hydrocarbons and mineral oils.

Hycar ebonite has excellent chemical resistance and is suitable for service conditions involving concentrated hydrochloric acid contaminated with small amounts of chlorinated hydrocarbons. Special flexible ebonite compounds may also be used in this service if the resistant rubber hydrochloride film is formed on the lining surface before putting new equipment into service. This may be done by exposing the lining to dilute hydrochloric acid at an elevated temperature for a short period of time.

Although Thiokol has excellent solvent resistance, it should not be used in contact with hydrochloric acid.

Butyl compounds have excellent resistance to concentrated hydrochloric acid and should be considered for high temperature service. Since it does not form a hydrochloride film on the surface, Butyl may be used where a lining is required to remain flexible over an extended period of time.

HIGH-SILICON IRONS

WALTER A. LUCE
The Duriron Co.
Dayton, Ohio

DURICHLOR has long been applied as an economical material of construction for handling all concentrations of hydrochloric acid at temperatures close to the boiling point. This includes most services which are normally encountered commercially, since boiling hydrochloric acid services are only occasionally used. Durichlor is one of the very few commercial alloys which merit consideration for strong hydrochloric acid solutions at temperatures above 150 deg. F. In addition, it is comparatively low in price.

Durichlor is a high-silicon iron alloy containing approximately 3 percent Mo in addition to the standard composition for Duriron (14.5 Si, 0.85 C and 0.65 Mn). This additional molybdenum greatly increases the resistance to hot hydrochloric acid solutions and to many corrosive chlorides above normal temperatures. Although the standard Duriron exhibits satisfactory resistance to hydrochloric acid solutions below 10 percent at temperatures approaching 150 deg. F, it can only be applied at normal temperatures for concentrations above 10 percent. How-

An Important, New Booklet . . .

Here are the facts about this new, 20-page booklet on the modern way to pump corrosives . . . the Model 40 Durcopump.

- It tells what Durco alloys the pump can be built in and gives a brief description of their physical characteristics.
- It shows and explains every feature and detail of the pump's construction.
- By means of cutaway and exploded views it lets you examine every part of the design.
- It explains the convertibility of the pump from one type of corrosive to another.
- It has a chapter on accessories and modifications.
- It tells about Durco's pump testing procedure.

THE DURIRON CO., INC.
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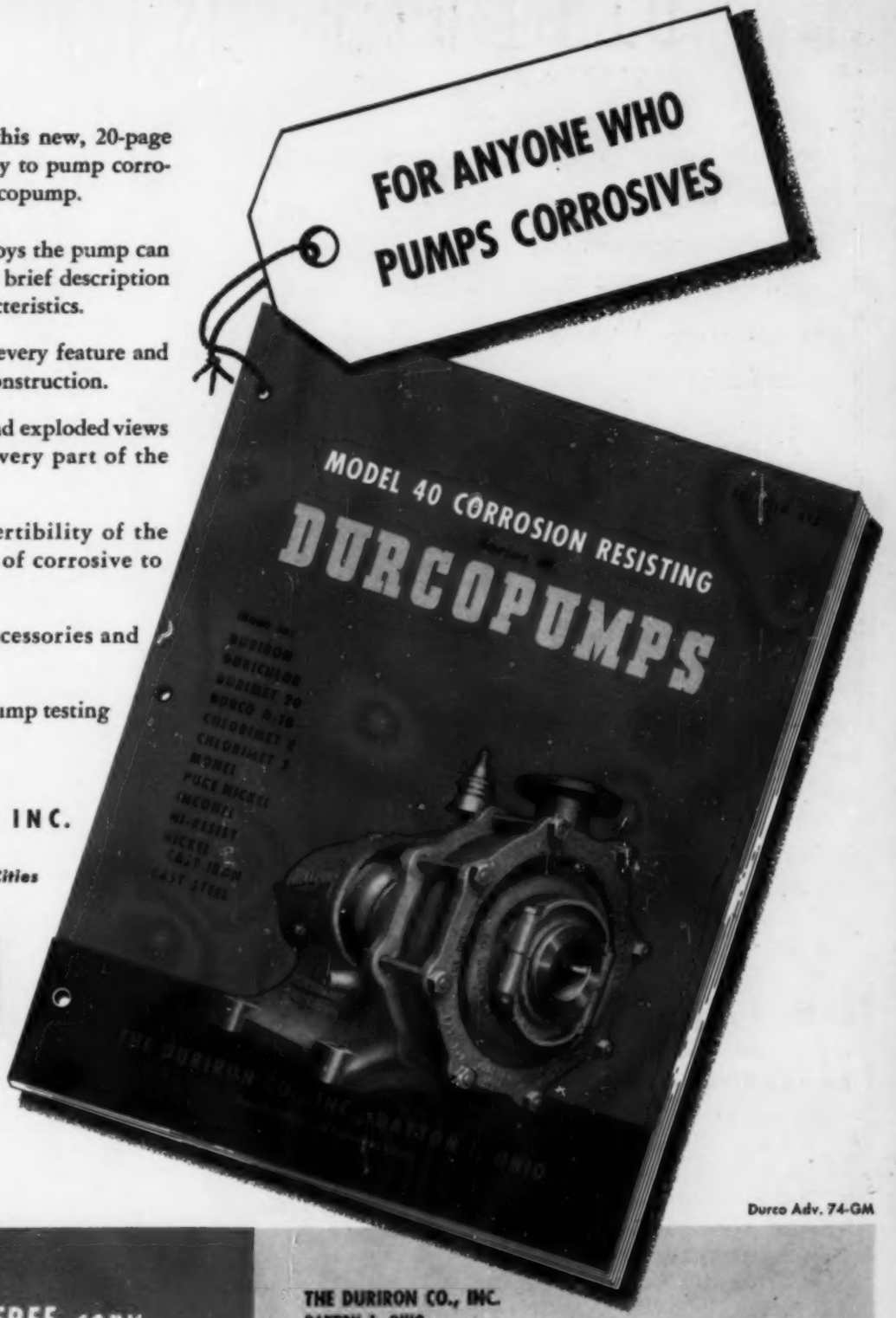
DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT



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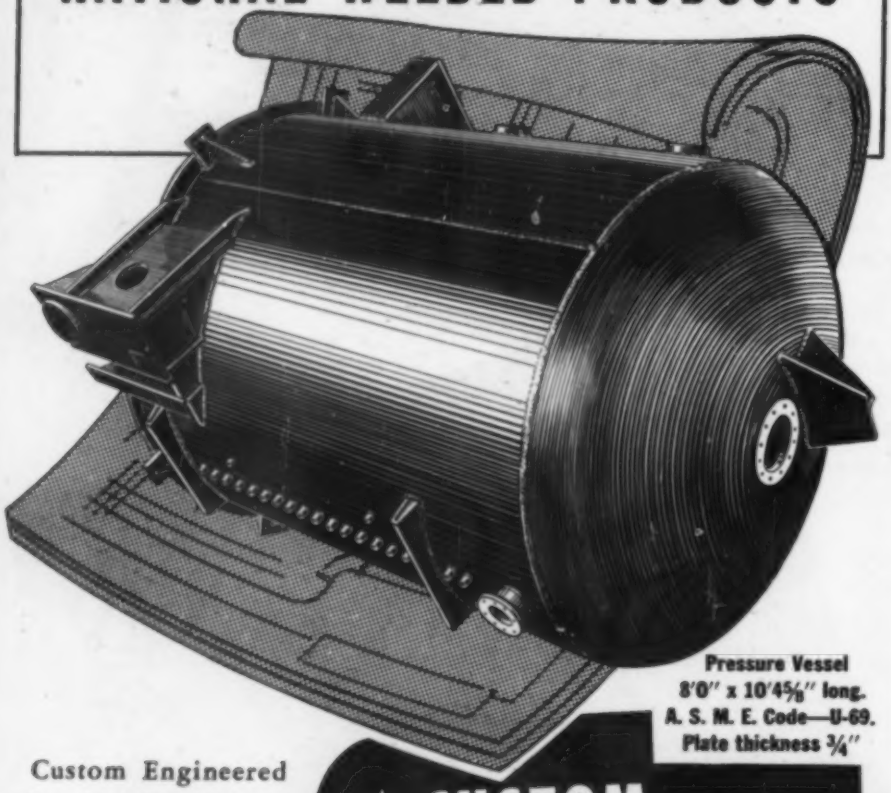

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8'0" x 10'4⅝" long.
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ANNEALING BOX COMPANY
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WASHINGTON, PENNA.

ever, Durichlor is usually applied in preference to Duriron for all hydrochloric acid services.

High-silicon iron equipment is available in the cast form only, and any required machining must be done by grinding. Duriron and Durichlor can be obtained in such standard equipment as pumps, valves, ejectors, fans, jets, spray nozzles, pipe, pipe fittings, anodes, strainers, and tank outlets. Laboratory equipment, tower sections, kettles, concentrator tubes, heat exchangers, immersion heaters and immersion coils are produced in Duriron only.

Typical installations involving high-silicon iron equipment in the chemical and metallurgical industries for hydrochloric acid handling are given below.

(1) A metallurgical plant uses Durichlor pumps for handling 30 percent hydrochloric acid and acidulated sludges containing 5 to 10 percent hydrochloric acid. The sludges are being handled at approximately 180 deg. F. This alloy is giving very satisfactory service life. (2) Extensive plant tests conducted on Durichlor in commercial hydrochloric acid at 120-130 deg. F. indicate that a service life of over 15 yr. can be expected for pumps, valves, pipe and fans. (3) A very large number of Durichlor pumps are used throughout the chemical industry for hydrochloric acid transfer at near normal temperatures. Over twelve years of service is recorded in a number of instances. (4) Plant tests conducted on various materials of construction for handling hydrochloric acid saturated with chlorine and containing decolorizing carbon and manganese dioxide at temperatures from 185-195 deg. F. indicate that Durichlor will give good service. All other alloys recommended for hydrochloric acid service were considered unsuitable. (5) A number of Durichlor pumps are giving good service in handling HCl-acidified allyl chloride in the production of synthetic glycerine. (6) In one installation a Duriron pump is giving satisfactory service in transporting cold, anhydrous hydrochloric acid during its manufacture.

The service life of Durichlor equipment may be greatly reduced by the presence of appreciable ferric chloride in hydrochloric acid solutions. Continuous recirculation of relatively pure acid often results in a build-up in ferric chloride which subsequently proves destructive. Therefore, the preceding discussion deals with solutions which are considered free of ferric chloride. However, the commercial muriatic acid normally encountered is sufficiently low in iron to be considered within the limits permitting economic use of the alloy.

How cold room door bucks are set and finished

Careful attention to small details is an important part of every good low-temperature insulation job. Take door bucks, for example. The way they are set means the difference between a door that swings easily and true and one that sags or twists and generally works badly.

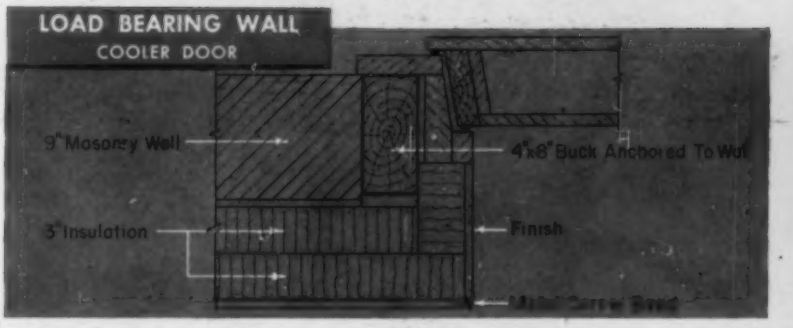
The way the insulation is finished off around the bucks and door frame is important, too. A good, tight job at that point eliminates the danger of hollow spaces where moisture and frost collect and break down insulating efficiency.

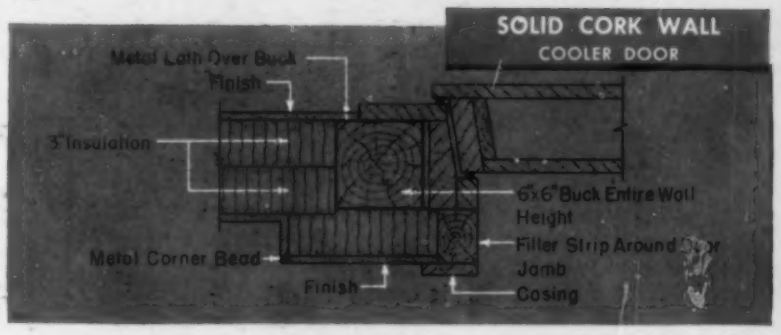
In permanent building walls, the bucks are built right into the wall and well anchored to it. In solid cork partitions or hollow tile walls, the door bucks must extend from the floor to the ceiling and must be securely bolted at both places. Perfect alignment of bucks and lintel is absolutely necessary.

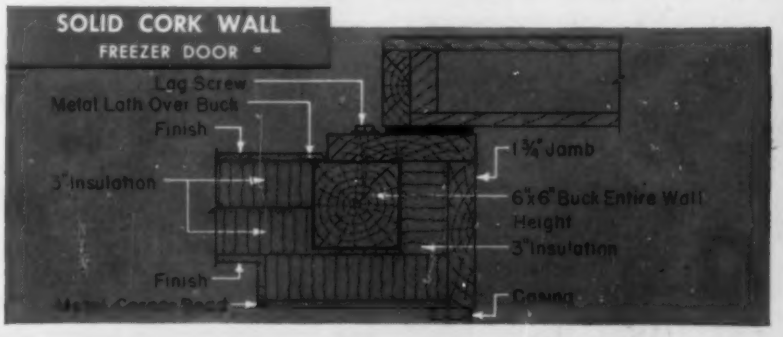
The finishing off of the insulation around the bucks depends upon the type of door used, the type of building construction, and whether the bucks are of wood or steel. The diagrams on this page illustrate a few typical finishing methods.

Correctly setting door bucks and finishing off the insulation around them are jobs for specialists. You can depend on the workmen of Armstrong's Contract Service to get these details right, just as you can depend on them for efficient erection of Armstrong's Corkboard, Mineral Wool Board, or Foamglas* insulations.

If you plan to build or enlarge your low-temperature rooms, it will pay you to get full information on this complete insulation service which includes expert engineering advice and quality materials, as well as skilled workmen to erect them. Write today to Armstrong Cork Co., Industrial Insulation Dept., 3312 Concord St., Lancaster, Pa.







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Simpson Intensive Mixer, model [illegible], 60 bu. capacity, mounted on a truck for use in a large chemical plant.

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All models offer the superior "mulling" principle of controlled mixing, to blend all types of dry, semi-dry and plastic materials better, faster at lower cost. In addition, SIMPSON MIXERS are available with all necessary equipment for use as reaction vessels, where reactions, heating, cooling, etc., can be completely controlled.

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1	Provide a complete "packaged" mixer in a small, compact unit suitable for laboratory or pilot plant use.	OK
2	Must have variable speed drive for all conditions.	OK
3	Must be completely jacketed for hot oil circulation.	OK
4	Provide both vacuum and pressure operation, for use as a reaction vessel.	OK
5	Provide complete, compact oil heating unit as part of mixer installation.	OK
6	Provide complete electric installation . . . explosion-proof motor, starter and light socket.	OK
7	Must have all stainless steel parts within mixing chamber for high corrosion resistance.	OK

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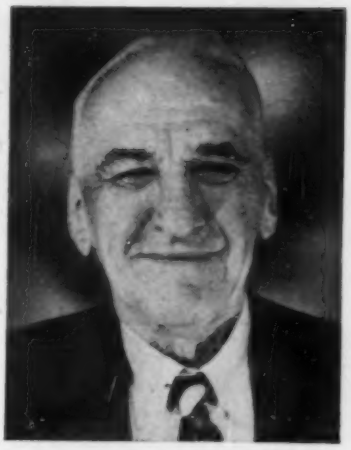
NAMES IN THE NEWS

Man of the Month



Eugene P. Schoch

Eugene Paul Schoch, professor of chemical engineering and director of the bureau of industrial chemistry at the University of Texas, is the first recipient of the Southwest Regional award established last year by the American Chemical Society. The award, consisting of a bronze plaque and $200, was presented at the annual banquet during the Southwest regional meeting of the ACS in Shreveport, December 9-11. The award, presented each year, is made for significant achievement in the chemical profession.

Dr. Schoch, nationally noted for his contributions to chemistry, chemical engineering and education in those fields, was born in Berlin in 1871. He received the degree of Civil Engineer in 1894 at the University of Texas and the M.A. degree two years later. In 1902 he received the Ph.D. from the University of Chicago, majoring in chemistry.

His teaching career at the University of Texas began in 1897, initially as instructor in chemistry and subsequently as adjunct professor, associate professor, and professor. He was professor of chemical engineering and physical chemistry during 1918-1938 and has been professor of chemical engineering from 1938 to date. He has been director of the bureau of industrial chemistry since 1914.

In addition to his long teaching career, Schoch has found time to engage in chemical and chemical engineering investigations covering natural resources of the Southwest including potash, lignite and natural gas. He has engineered a number of water purification plants in Texas communities. For a long period he has directed a study of the chemical effects of the electric discharge through gases and was responsible for the building of a large pilot plant for development work in this field at the university. Results indicating the successful conversion of natural gas into acetylene have recently been disclosed. Further work directed to the production of liquid products from natural gas is under way.

His society affiliations include ACS, AIChE, Sigma Xi, Tau Beta Pi, Phi Beta Kappa, and life membership in the Texas Society of Professional Engineers.

Reginald P. Lukens, Blythe M. Reynolds, Eugene J. Lyons and **J. L. K. Snyder** are newly appointed vice presidents of Merck & Co., Rahway, N. J. They are in charge, respectively, of production, engineering and purchasing, personnel, and domestic sales.

Joseph C. Elgin, chairman of the Princeton University department of chemical engineering, has been elected chairman of the division of industrial and engineering chemistry of the American Chemical Society. Dr. Elgin succeeds **H. F. Johnstone** of the University of Illinois.

Edmund B. Besselievre, engineer in charge of the Dorr Co.'s sanitary engineering work in South America, has returned to that territory after a four month visit to his company's head office in New York. He will make his headquarters for the immediate future in Sao Paulo, Brazil.

Robert B. Wittenberg has resigned as manager of the potash chemicals department of International Minerals & Chemical Corp. to accept the position of assistant to the president of J. T. Baker Chemical Co.

Ada K. Coller, Lena L. Dunn, Martha L. Markovich and **Jane L. Simpson** are recent additions to the staff of Harris Research Laboratories, Washington.

J. Hevrosky of Czechoslovakia, one of Europe's outstanding analytical chemists, will become a member of the college of chemistry and physics at Louisiana State University.

John S. Cort, Jr., has been appointed assistant to the president of Martin Dennis Co. of Newark and Kearny, N. J. The company, a subsidiary of Diamond Alkali Co., manufactures chromium chemicals.

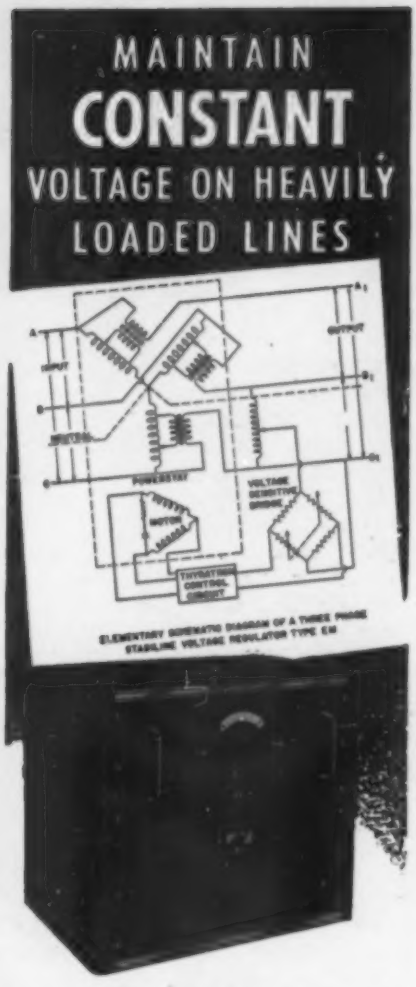
J. S. Cort, Jr.

F. J. Curtis

Francis J. Curtis, vice president and secretary of the executive committee of the Monsanto Chemical Co., St. Louis, Mo., has been elected president of the American Institute of Chemical Engineers. Serving with Mr. Curtis in the office of vice president will be **Warren L. McCabe,** former head of the chemical engineering department at Carnegie Institute of Technology, and now director of research of the Flintkote Corp.

James J. Eberl has been appointed director of chemical research of the Scott Paper Co.

Vannevar Bush, until recently chairman of the research and develop-



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In the plant — as in the laboratory — constant voltage is a necessity. It can be maintained to large industrial loads by using STABILINE (Electromechanical) Automatic Voltage Regulators.

These units feature zero waveform distortion; complete insensitivity to magnitude and power factor of load; no effect on system power factor; no critical adjustments; high efficiency; adjustable output voltage. Available for a wide range of applications in 115, 208, 230, 440 volt, single and three phase ratings; capacities to 100 KVA.

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THE SUPERIOR ELECTRIC COMPANY
212 MEADOW STREET
BRISTOL, CONN.

ment board of the National Military Establishment, has been awarded the 1949 medal of the Industrial Research Institute, Inc. Presentation will be made in February.

F. Scott Carpenter, Jr., has been appointed to the special carbon blacks section of the research and development department of Godfrey L. Cabot, Inc., Boston. Mr. Carpenter was formerly associated with the Grasselli Chemicals Division of E. I. du Pont de Nemours & Co.

Meyer Moskowitz, formerly with the research departments of Corn Products Refining Co. and Doughnut Corp. of America, has joined the consulting firm of James F. Walsh and Associates as eastern associate, specializing in the problems of dry and wet milling food technology.

Glenn B. Hess, formerly associated with Vick Chemical Co., has joined the staff of the analytical department of Chas. Pfizer & Co. at their Brooklyn plant.

Alexander Leggin has been appointed assistant to T. H. Vaughn, vice president-research, Wyandotte Chemical Corp. Mr. Leggin, with offices in Washington, D. C., will act as liaison with government agencies.

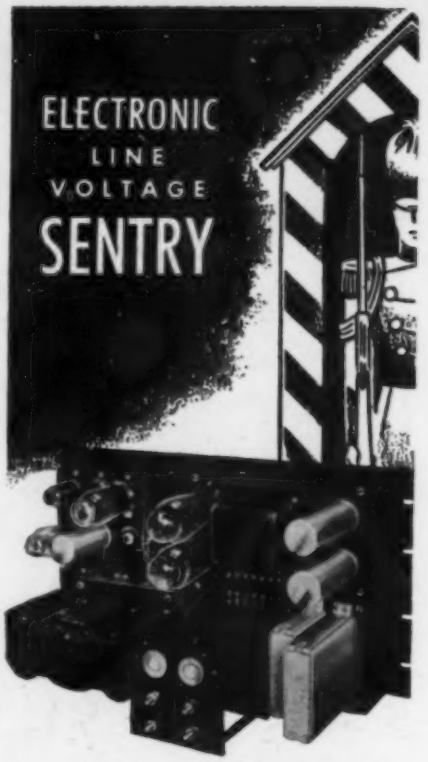
A. Leggin

D. S. Le Beau

Desiree S. Le Beau, director of research of the Midwest Rubber Reclaiming Co., East St. Louis, Mo., has been elected chairman of the division of colloid chemistry of the American Chemical Society. Dr. Le Beau, the first woman to head the division, succeeds **Robert D. Vold** of the University of Southern California.

Oscar H. Fager has been appointed to head the newly created special products division of Roosevelt Oil and Refining Corp. at Mt. Pleasant, Mich.

Robert Simha, consultant for the division of organic and fibrous materials of the National Bureau of Standards, is spending four months in Europe to study the status and trends of high-polymer research in



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various government, academic, and industrial institutions.

Allan P. Colburn, assistant to the president, University of Delaware, last month received the first Professional Progress Award of the American Institute of Chemical Engineers. The award, to be made annually, is sponsored by the Celanese Corp. of America.

C. B. Johnson has been named chief engineer and **E. R. Gilmore** is director of research for the Pittsburgh equitable meter division of the Rockwell Manufacturing Co.

James R. Donnalley has been appointed manager of General Electric's silicone manufacturing plant at Waterford, N. Y.

Robert L. Gibson, manager of the plastics division of the General Electric Co.'s chemical department, has been named assistant general manager of the department.

E. Y. Wolford has appointed manager of plastics development for the chemical division of Koppers Co., Pittsburgh.

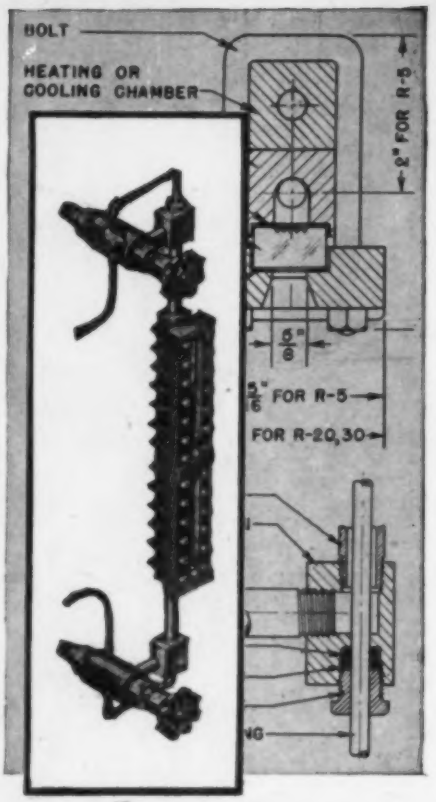
Norman C. Baenzinger, formerly in the chemistry department of the Iowa State College, Ames, has joined the staff of Mellon Institute's department of research in chemical physics as fellow in X-ray diffraction.

Robert N. Wolfe, currently manager of the company's branch plant in Hutchinson, Minn., has been named manager of operations at the new plant of the Minnesota Mining & Manufacturing Co. in Bristol, Pa.

C. E. Kenneth Mees, Kodak vice president in charge of research, received the first presentation of the Progress Medal of the Photographic Society of America at the Society's 1948 convention in Cincinnati last month.

L. Lee Bennett, Jr., James A. Johnson, Jr., James W. Marsh, Frazer Banks, Jr., Rachel Parker, Mary C. Wheeler and **Linda K. Simpson** are recent additions to the technical staff of the Southern Research Institute, Birmingham, Ala.

G. M. Hebbard, vice president in charge of operations for the Davison Chemical Corp., Baltimore, has been appointed a member of the Maryland State Board of Registration for Professional Engineers and



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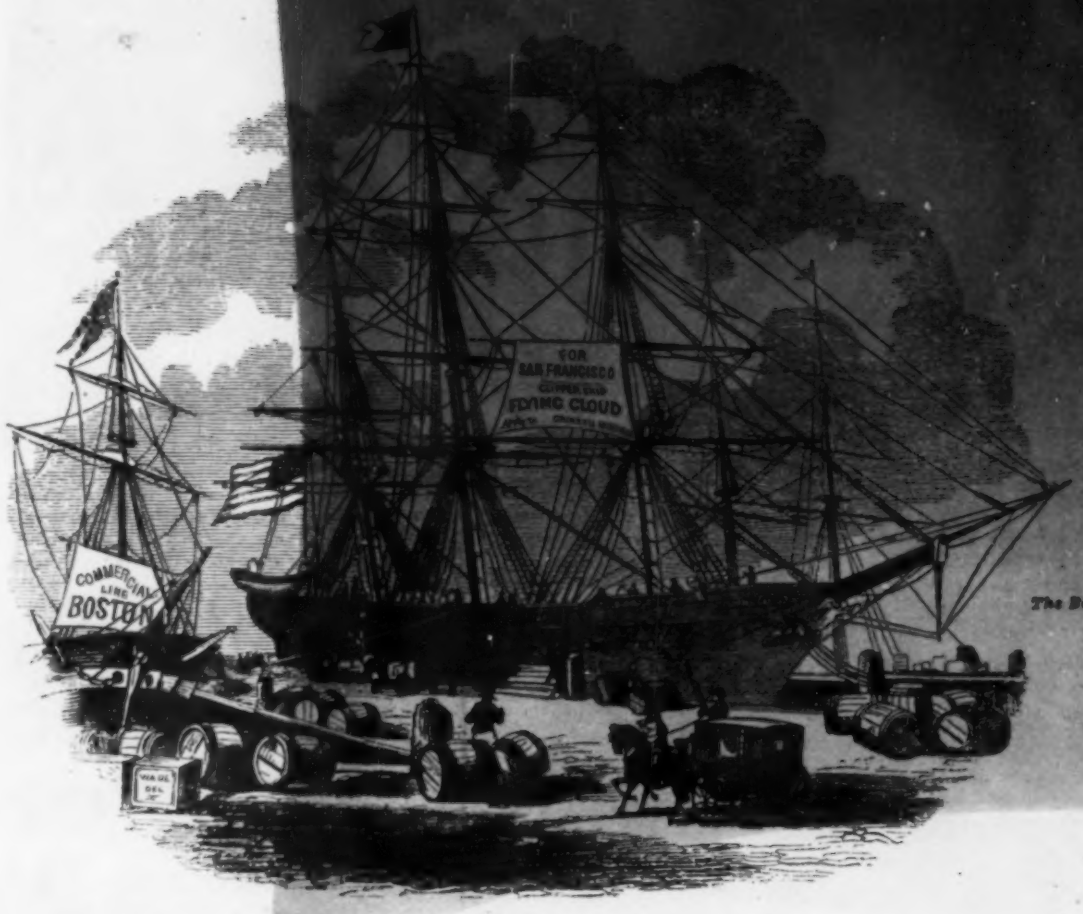

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Land Surveyors. Dr. Hebbard's appointment extends to June 1, 1952.

W. C. Pollard, formerly with the Chrysler Corp. at Highland Park, Mich., has joined the Chicago research staff of Graham, Crowley & Associates, Inc. Mr. Pollard's new activities will involve research in primary cells and other related phases of electrochemistry.

A. E. Lacomble

M. E. Spaght

A. E. Lacomble, president of Shell Development Co., has been elected chairman of the board as of Jan. 1, 1949. **M. E. Spaght,** vice president, has been named to succeed Dr. Lacomble as president.

Joseph H. Koffolt, a member of the Ohio State University faculty since 1929, became chairman of the chemical engineering department on October 1.

Harry F. Pfann has been appointed manager of the chemical development section, chemical division, of Koppers Co., Inc.

Harold J. Miller, former assistant professor of plant pathology at Pennsylvania State College, has been named as senior plant pathologist at Whitemarsh Research Laboratories of Pennsylvania Salt Manufacturing Co.

Clifford F. Evers has been named as Head of the U. S. Fishery Technological Laboratory at College Park, Md., by Fish and Wildlife Service. Mr. Evers formerly directed the technical work of the National Association of Frozen Food Packers.

Z. Smilow, chemical engineer in the chemical products works of the lamp department of General Electric Co., recently retired after 40 years of service with the company. He was intimately connected with important chemical developments of the industry.

James Tanham has been elected chairman of the board of the National Safety Council. Tanham, who is vice president of the Texas Co., has been active in the field of industrial

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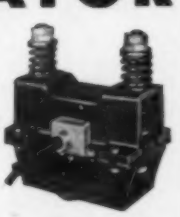

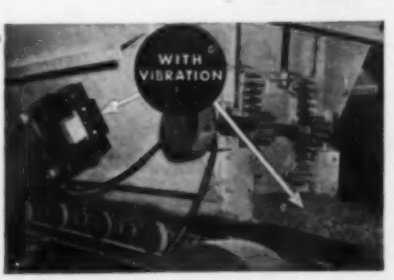

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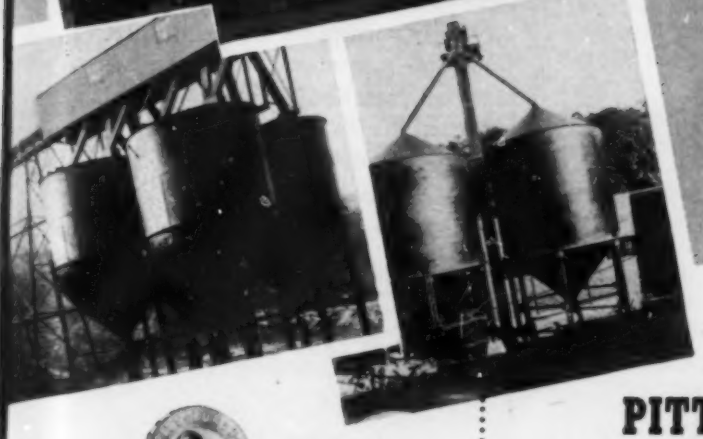

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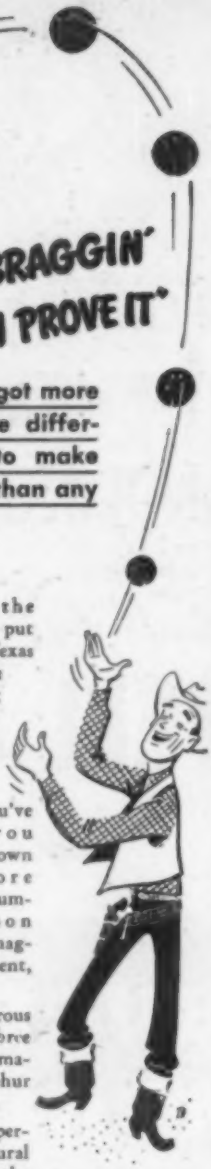

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relations for several years. He is also chairman of the executive committee and member of the board of directors of the Greater New York Safety Council.

Charles E. Reed of Schenectady has been named engineering manager of the chemical department of the General Electric Co. in Pittsfield. In his new position, Dr. Reed will have responsibility for new product development, chemical engineering process development, methods and equipment development, facilities engineering and engineering policy for the department.

C. E. Reed

J. G. Dean

John G. Dean has been appointed head of the industrial chemicals section, development and research division of the International Nickel Co.

Kenneth C. D. Hickman has concluded arrangements by which he will serve both Eastman Kodak Co., Rochester, N. Y., and Arthur D. Little, Inc., Cambridge, Mass., as consultant.

Luther B. Martin, technical director of tire production for United States Rubber Co., retired November 1 after 30 years of continuous service.

Georg E. Cronheim research director of the S. E. Massengill Co., Bristol, Tenn., has been elected chairman of the northeast Tennessee section of the American Chemical Society. He succeeds **Edward M. McMahon** of the Tennessee Eastman Corp., Kingsport.

G. Warren Heath has joined Irving R. Boody & Co., New York, as manager of the chemical and pharmaceutical department.

Louis S. Fryer, vice president in charge of production of Industrial Rayon Corp., has resigned from that company.

Winston H. Reed is the recipient of a research fellowship established by the Carrier Corp. of Syracuse, N. Y., in the chemical engineering department at Virginia Polytechnic In-

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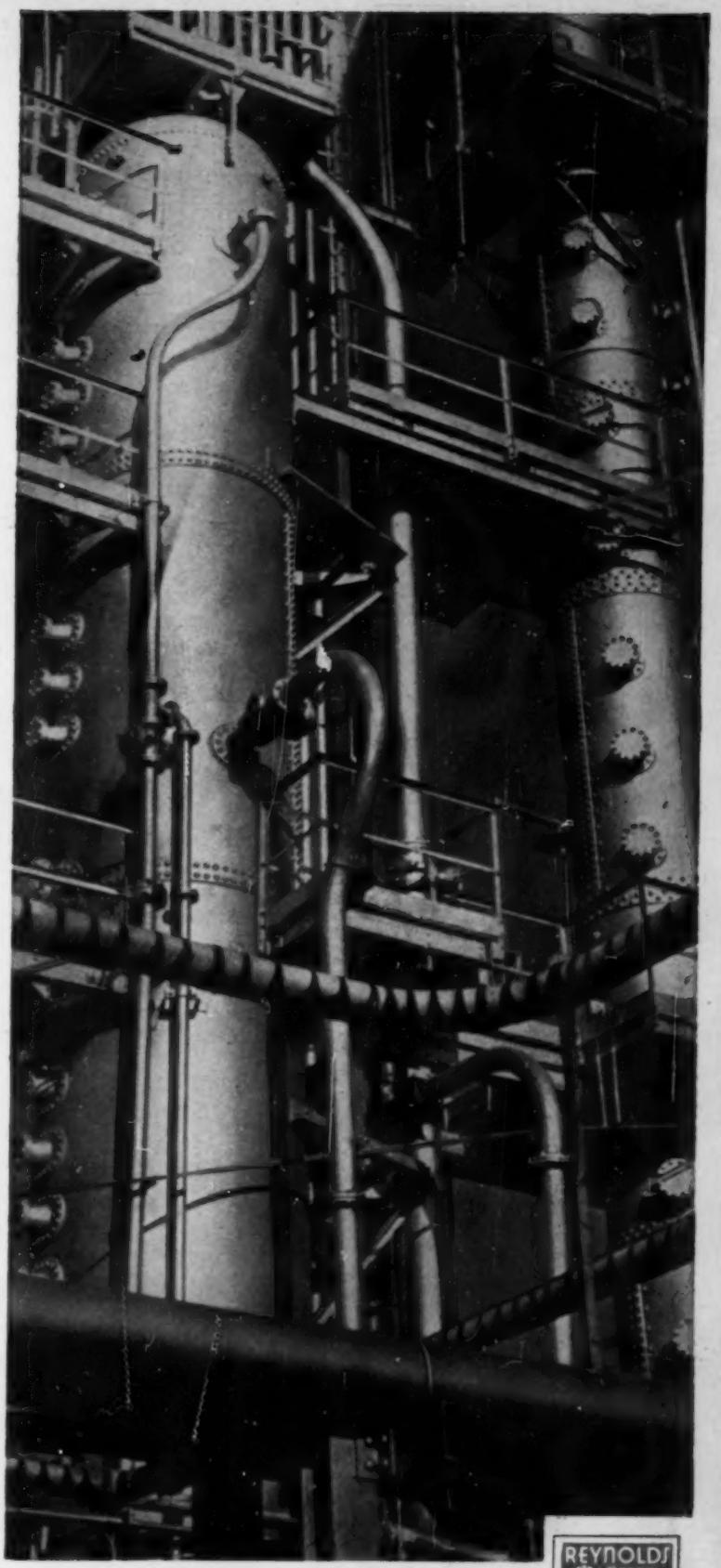

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STAINLESS STEEL OR NICKEL ALLOY

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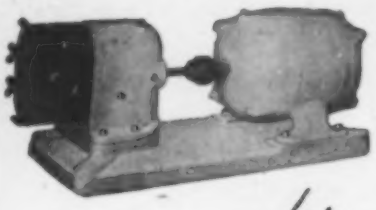

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Leonard T. Pool, formerly a chemical engineer with U. S. Industrial Chemicals, has joined the design branch, plants division, technical command, Army Chemical Center, Md. Recent chemical engineering graduates added to the technical command staff include: **Henry M. Drupieski, Marshall Gilchrist,** and **George N. Fountas.**

William W. Pigman, organic group leader at the Institute of Paper Chemistry, Appleton, Wis., has been elected chairman of the division of sugar chemistry and technology of the American Chemical Society.

Irving Bachman, a chemical engineer in the design branch, plants division, technical command, Army Chemical Center, Md., is now a member of the faculty of McCoy College, Johns Hopkins University, Baltimore, Md.

Edward H. Berger, chief chemist and asphalt consultant for Johns-Manville Corp., has been awarded the honorary degree of doctor of science by Franklin and Marshall College, Lancaster, Pa.

I. M. Kolthoff of the University of Minnesota has been awarded the William H. Nichols Medal of the New York Section of the American Chemical Society for 1949 for his world leadership in the development of modern analytical chemistry. Presentation of the medal will be made next March.

Harry K. Collins of Schenectady and **John L. McMurphy** of Pittsfield have been named to managerial posts of the plastics division and the chemicals division respectively of the chemical department of the General Electric Co.

Joseph H. Whitney has joined the staff of the chemistry and chemical engineering research division of Armour Research Foundation of Illinois Institute of Technology as an associate physical chemist.

Peter Van Wyck, manager of the Virginia cellulose division of the Hercules Powder Co. experiment station, has been appointed technical assistant to the Hercules director of research. **Richard E. Chaddock,** who has been handling technical assistance in this field, now will take over responsibility for

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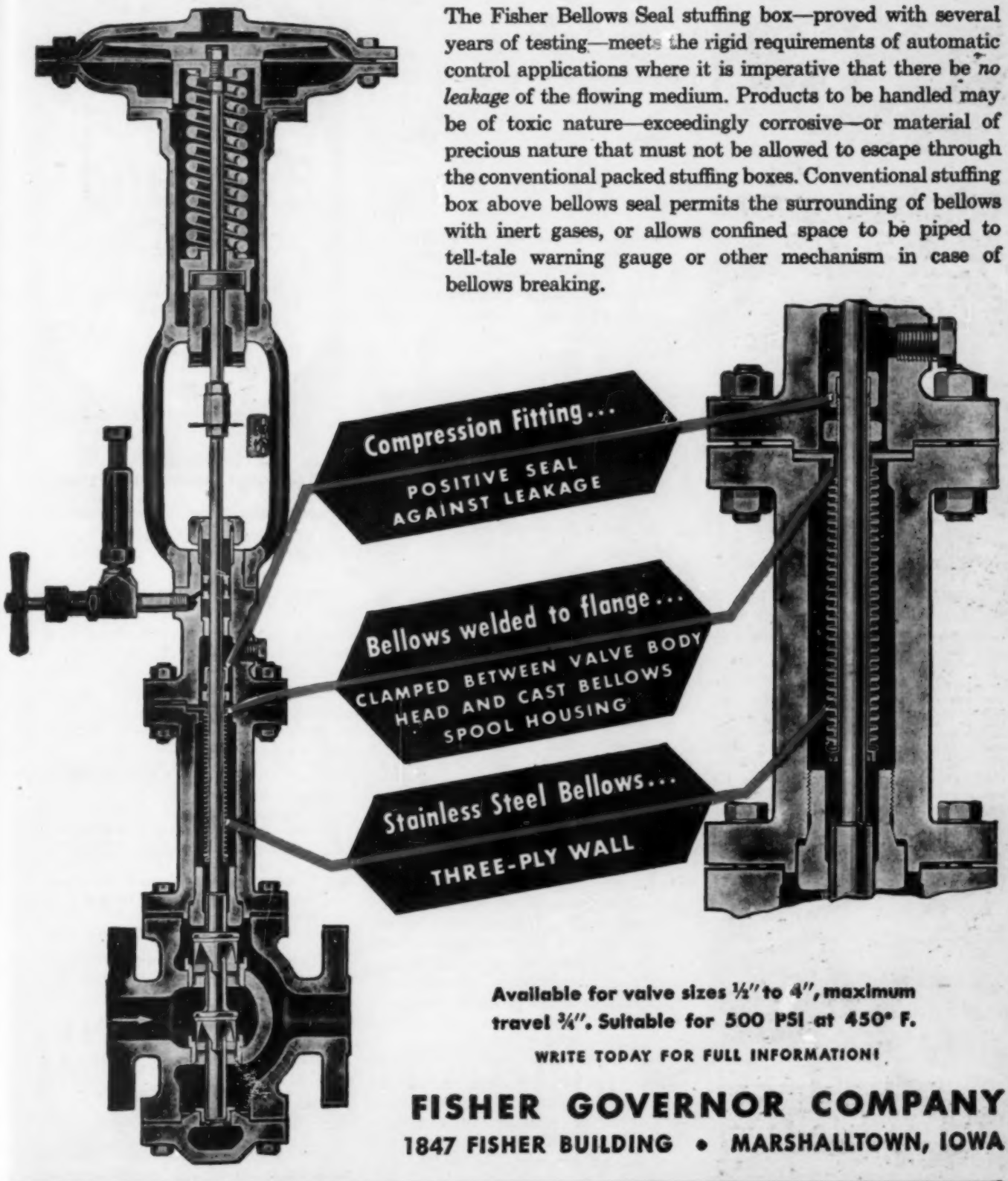
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technical assistance on sales development. **Arthur F. Martin** will replace Dr. Van Wyck as manager. **E. L. Jones,** operating supervisor at the Hopewell plant, succeeds Dr. Martin as chief chemist of the plant.

J. Edward Vivian, associate professor of chemical engineering at the Massachusetts Institute of Technology, and **Roy P. Whitney,** research associate at the Institute of Paper Chemistry, won the Junior Award of the American Institute of Chemical Engineers. The honor, given annually for published articles of merit, was conferred upon both men November 8 in New York.

Frank K. Savage has recently been elected vice president of Graham, Crowley & Associates, Inc., Chicago. He will direct company efforts in connection with consultation, research and development in the electroplating field in the middlewestern area.

Donald Q. Kern has joined the process engineering division of the Patterson Foundry & Machine Co., New York, and has been appointed director of engineering of that division.

D. Q. Kern

W. L. Walsh

William L. Walsh, of East Greenbush, N. Y., has been appointed manager of the Rensselaer, N. Y., plant of General Aniline & Film Corp.

Gilbert Thiessen, formerly development manager of the chemical division, Koppers Co., has been named technical advisor for that division. Dr. Thiessen will devote his time to the coordination and advisory direction on technical matters relating to the development, sale, and use of products, produced or to be produced in plants of the division.

Ernest F. Fiock, a leading authority in the field of combustion, has been appointed chief of the newly organized combustion section of the National Bureau of Standards. The increasing importance of combus-

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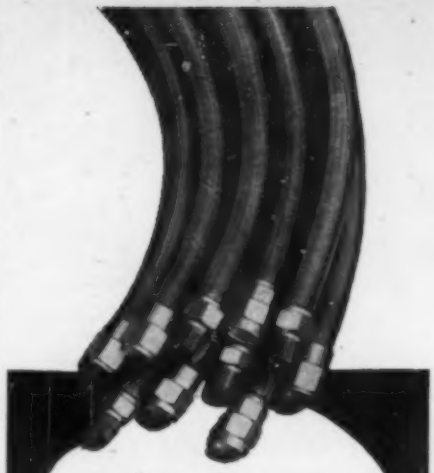

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offers 5 metals to meet every requirement . . . .

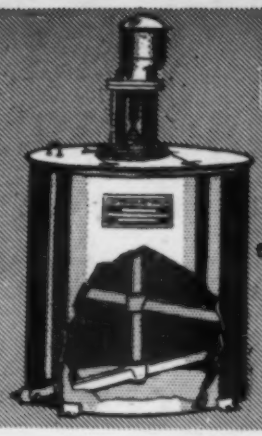
You don't need to get along with tubing that is "almost good enough" when you specify TITEFLEX. For you have your choice of FIVE metals for the innercore—brass, bronze, monel, inconel, and stainless—to satisfy all specifications for temperature and corrosion resistance. For example, the top working temperatures of tubing made from these metals are as follows:

Brass	250° F.
Bronze	325° F.
Monel	800° F.
Stainless	800° F.
Inconel	1700° F.

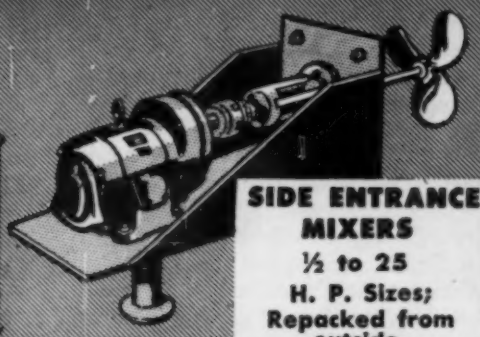
The latest edition of Titeflex Catalog No. 113 will give you more complete information on these materials, as well as other useful facts about TITEFLEX, the *All-metal* flexible tubing. Write for your free copy today.

TITEFLEX, INC.
523 Frelinghuysen Ave. • Newark 5, N. J.

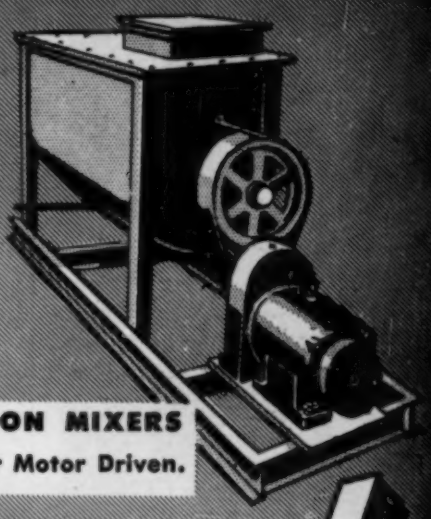
Titeflex
All-Metal Flexible Tubing



MIXERS AND KETTLES
Complete with Tank and Drive Unit in various types and sizes, with any style stirrers, propellers or turbine.



SIDE ENTRANCE MIXERS
½ to 25 H. P. Sizes; Repacked from outside.

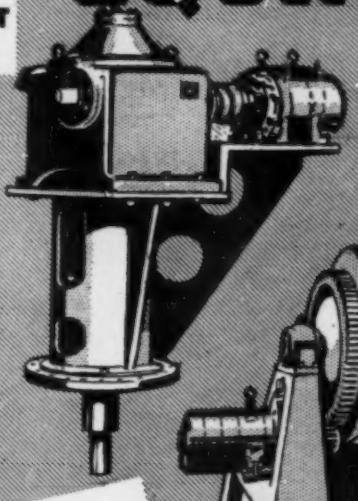


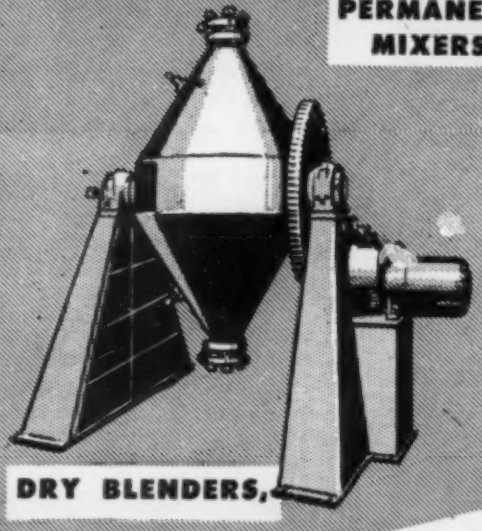
RIBBON MIXERS
Belt or Motor Driven.

PORTABLE MIXERS

International Chemical Processing EQUIPMENT

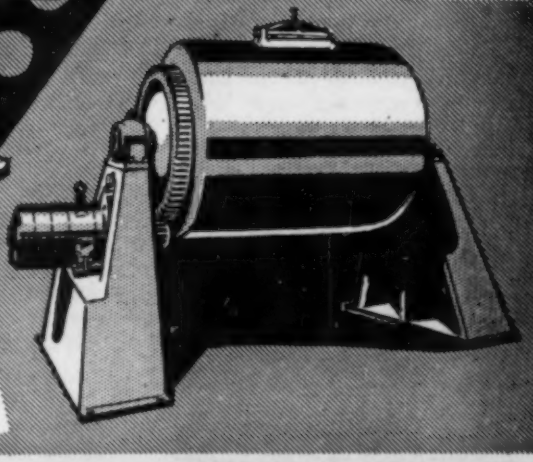
PERMANENT MIXERS





DRY BLENDERS,

BALL AND PEBBLE MILLS



***NEW* CATALOGS**
On Mixers, Agitators, Blenders, Ribbon Mixers, etc., Now ready.
CATALOG No. 85 on BALL MILLS—Either catalog or both sent on request.

INTERNATIONAL ENGINEERING, INC.

NEW YORK
15 Park Row

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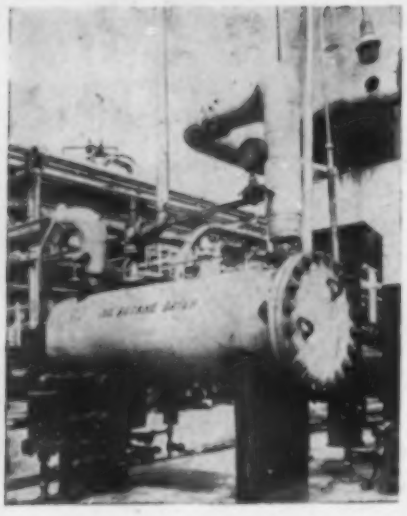
CHICAGO
407 S. Dearborn St.

LOS ANGELES - 150 N. NORTON AVE. - FERNHOLTZ MACHINERY CO.



EXCEL-SO

SEPARATORS

Solve The Problem

MODEL HHP-300 EXCEL-SO SEPARATOR FOR DRYING OF ISO. BUTANE

This separator has been in operation for almost 3 years. Its purpose is to remove water from Iso. Butane in the alkylation plant of Humble Oil & Refining Co., in Texas. Old methods required large settling tanks and a long settling period or the very expensive process of activated alumina dehydration. This unit paid for itself about every ten days in the saving of acid since the removal of water from the steam prevents dilution of the acid.

USE THIS COUPON

WARNER LEWIS COMPANY

BOX 3096C TULSA OKLAHOMA

Please send Information on your Model HHP-300

EXCEL-SO

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Street _____

City _____

tion research, particularly its application to gas turbines and jet engines, has made the formation of a separate section devoted to large-scale research necessary.

Kennet[1]- M. Watson, professor of chemical engineering at the University of Wisconsin and engineering consultant, was given this year's William H. Walker Award of the American Institute of Chemical Engineers in New York on Nov. 8. The award is an annual presentation given for a contribution of outstanding importance in the chemical engineering literature.

K. M. Watson

R. L. Savage

Robert L. Savage, formerly research engineer and assistant supervisor of chemical engineering research at Battelle Memorial Institute, Columbus, Ohio, has been appointed assistant professor of chemical engineering at Case Institute of Technology, Cleveland.

Leon A. Sweet, director of chemical research and products development of Parke, Davis & Co., Detroit, has been elected chairman of the division of medicinal chemistry of the American Chemical Society.

William W. Eaton has joined the central research organization of Olin Industries, New Haven.

James H. Conolly has recently joined the Chicago staff of Graham, Crowley & Associates, Inc. Mr. Conolly was formerly with the Newton Falls division of the Standard Steel Spring Co. as electroplating and industrial waste disposal engineer. Mr. Conolly's new duties will involve research in the field of electrochemistry.

Hyman Iserson and **Maurice E. Miville** have been appointed research chemists at the Whitemarsh Research Laboratories of Pennsylvania Salt Manufacturing Co.

H. Leroy Thompson has been appointed general operations manager of Mississippi Chemical Corp. Mr. Thompson was formerly associated with the division of chemical en-

Sutton, Steele & Steele

AIR TABLES

are more sensitive concentrators than any other type of gravity separators

You cannot use wet tables or use flotation reagents on half-inch particles . . .

you CAN use AIR TABLES.

You cannot separate by wet tables or flotation reagents round from flat particles . . .

You CAN with AIR TABLES.

You can't treat 5 to 8 tons per hour on a single unit of wet table or flotation cell . . .

You CAN with an AIR TABLE.

You cannot size needle-like crystals with screens.

You CAN size such particles with an AIR TABLE.

Our engineers will be glad to help solve your separating or concentrating problems and submit recommendations. Send sample for laboratory tests.

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Separations Engineering Corporation
110 EAST 42nd STREET, NEW YORK, N. Y.
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FLOUR EXCHANGE BUILDING
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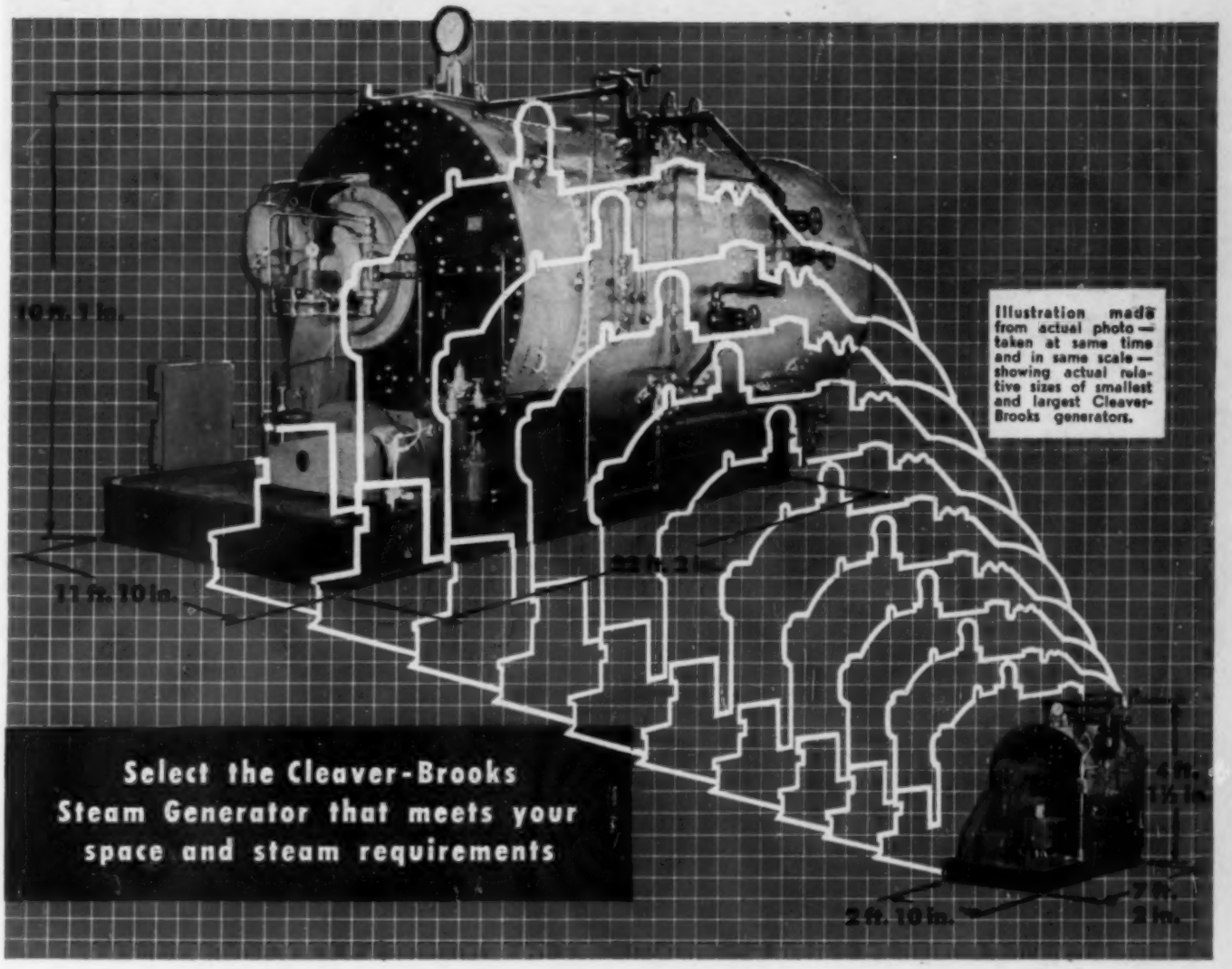
SAN FRANCISCO, CALIFORNIA

S&S THE PROCESS FOR BETTER PRODUCTS—FASTER

WHY SHOP FOR A BOILER??


10 ft. 7 in.
11 ft. 10 in.
22 ft. 2 in.
4 ft. 7½ in.
2 ft. 10 in.
7 ft. 2 in.
Illustration made from actual photo — taken at same time and in same scale — showing actual relative sizes of smallest and largest Cleaver-Brooks generators.
Select the Cleaver-Brooks Steam Generator that meets your space and steam requirements

WHY search and shop for a boiler — install a Cleaver-Brooks engineered and packaged steam generator that fully meets your steam requirements and needs only a minimum of space and headroom.

You can select from a range of sizes 15 to 500 hp. — and you can have your Cleaver-Brooks steam generator equipped for oil, gas, or with a combination burner which permits alternate use of gas or oil and provides for a quick change-over from one fuel to the other.

Equally important — you get Cleaver-Brooks guarantee of at least 80% efficiency from full load down to 30% of rating — with either gas or oil as fuel — and IN ALL SIZES.

Cleaver-Brooks steam generators enable you to burn the available fuel in your area — give you clean, smokeless operation—eliminate fuel and ash handling — need no high or costly stacks — no special foundations — fit under low headroom and into limited space — provide flexible operation to meet fluctuating loads — fully meet all codes.

Oil or Gas Fired . . . Guaranteed 80% Efficiency from Full Load Down to 30% of Rating . . . IN ALL SIZES

Available in a size to fit your needs — 15 to 200 p.s.i., 15 to 500 hp.—write for Cleaver-Brooks Steam Generator bulletin.

CLEAVER-BROOKS COMPANY, 339 E. Keefe Ave., Milwaukee 12, Wis.

WRITE on your business letterhead for Free Steam Cost Calculator — a ready reference slide rule showing the comparative steam costs when using oil, gas or coal as fuel.

Cleaver-Brooks

"Packaged" STEAM GENERATORS

HAVE SERVED INDUSTRY FOR MORE THAN FIFTEEN YEARS

TYPE

DS

PEERLESS
Centrifugal
PUMPS

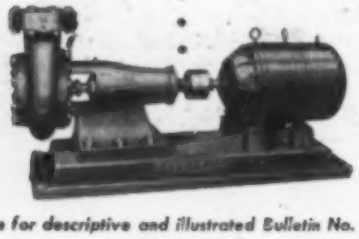
PROCESS SERVICES
ABRASIVE
AND CORROSIVE LIQUIDS

TYPE
DS
ENCLOSED IMPELLER

Application:
The Type DS pump is a general purpose process pump with enclosed impeller. Handles clear liquids in a variety of services and solutions which may be corrosive. Single-stage, single-end suction design. Capacities: up to 600 g.p.m.; heads up to 231 feet; temperatures up to 212 F. All types of drive.

TYPE
DSO
OPEN IMPELLER

Application:
The Type DSO pump has essentially the characteristics and applications as the Type DS. However, the Type DSO utilizes an open impeller with impeller vanes on back of shroud to permit pumping of fluids with solids in suspension, brines, sludges and the like. Capacities: to 1500 g.p.m.; heads: to 231 feet; temperatures up to 212 F. All types of drive.



Write for descriptive and illustrated Bulletin No. 803

fmc PEERLESS PUMP

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Indianapolis, Ind.; Los Angeles 31, Calif.
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 No. Broadway; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California.

gineering, Tennessee Valley Authority, as staff chemical engineering consultant and as a project leader in process development.

Hugh D. Moncur, Jr., is president and general manager and **K. N. Paboojian** is vice president in charge of production for Ingram Laboratories of San Francisco.

Carl S. Miner, consulting chemist, has been named to receive the 1949 Perkin Medal. The award, made annually for outstanding work in applied chemistry, will be presented January 7 at the meeting of the American Section of the Society of Chemical Industry.

Emil D. Ries has been appointed general manager of the ammonia department of E. I. du Pont de Nemours & Co. He succeeded **Walter Dannenbaum** who is now a vice president, director, and member of the executive committee. **R. L. Hershey,** formerly assistant chemical director, was made assistant general manager.

OBITUARIES

Edward B. Yancey, 60, vice president and member of the board of directors of E. I. du Pont de Nemours & Co. under whose direction Du Pont built and operated the Hanford atomic-energy plant, died in Wilmington October 24.

Mahlon J. Rentschler, 66, general manager and director of research for Barium and Chemicals, Inc., which he helped found, died in Cleveland October 25.

Robert W. Porter, 60, assistant to the president of the National Radiator Co., died suddenly in his home at South Orange, N. J., October 26.

Henry F. Heil, 64, before his retirement in 1940 vice president and treasurer of the National Refining Co., died in Cleveland November 3.

William G. Beckers, 74, a manufacturing chemist well known in the American dyestuff industry, died in New York November 3.

Frank N. Pond, 78, manufacturing chemist and president of the Pond Chemical Co. in New York, died in his home at Douglaston, L. I., November 16.

Frederick G. Cottrell, 71, inventor of the Cottrell Precipitator and founder of the Research Corp. died in California, November 16.

SAFETY FIRST

WHEREVER DUST, EXPLOSIVES, INFLAMMABLES OR FUMES CREATE A HAZARD

WHEELER
SELF-POWERED TELEPHONES

ABSOLUTE PROOF AGAINST SPARKS and FIRE HAZARD
CORROSION RESISTANT

No batteries or other power connections are used for voice transmission or bell. Transient noises are eliminated, leaving the voice clear and distinct. Operation cannot fail due to loss of power. Compact and convenient. Efficient up to 20 miles. Comparable in quality and size to standard telephone sets. Koiled Kord equipped for convenience and long service. See your jobber or write today for booklet SA-8.

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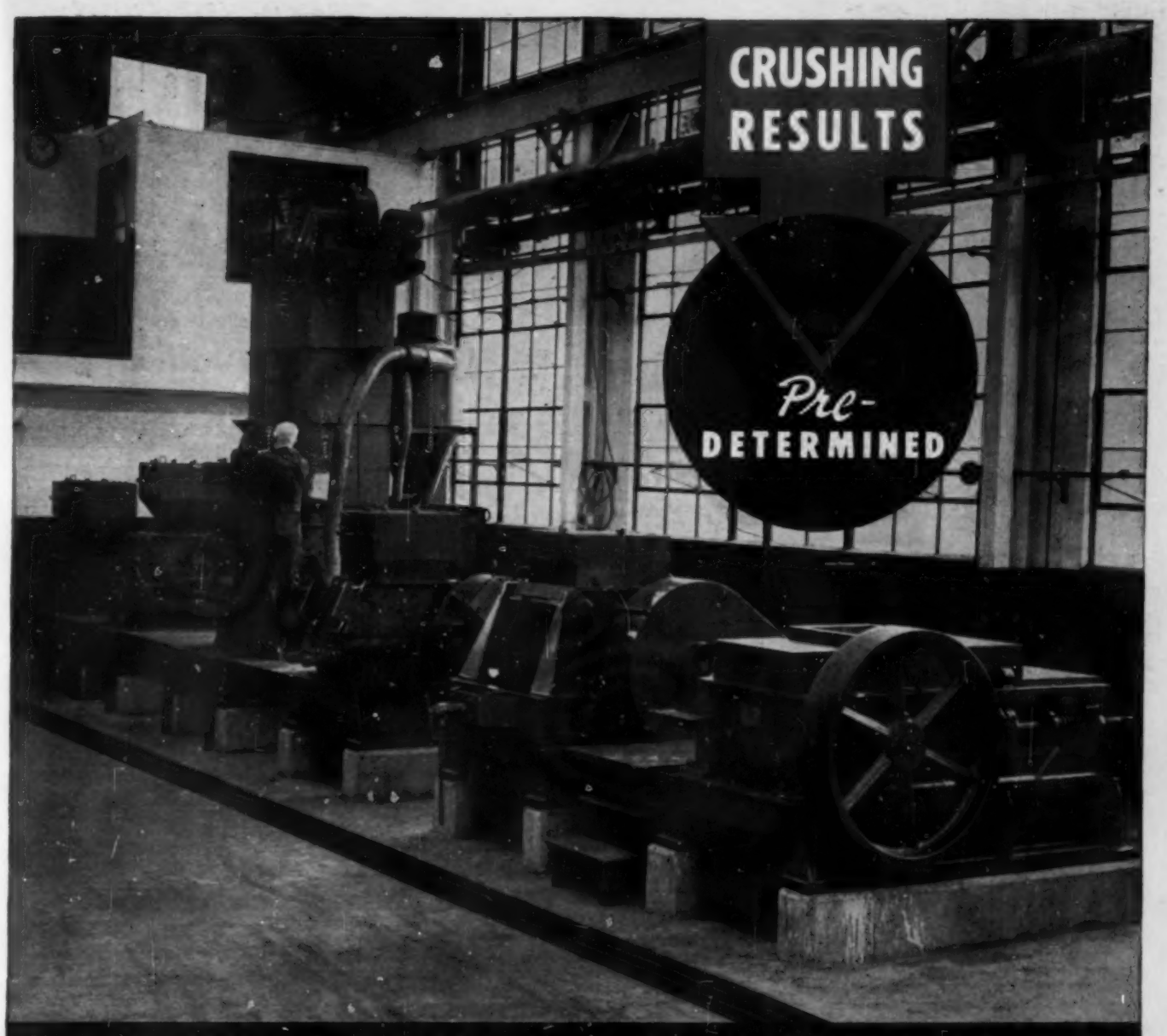
SERVICE QUALITY WHEELER DEPENDABILITY

DIVISION OF THE SPERRY CORPORATION
MAGNET WIRE • COILS • BALLASTS



Size of feed, specific size of product and capacity are important factors in most processes. Illustrated is the Crusher Test Division of our New Research Center. Equipped with various types of crushers and pulverizers it is possible to tell you *accurately* the proper type and size of machine best suited to your particular material . . . in advance of any investment or installation. Data is available on existing installations as well as results of many tests. If your material is not included we will be glad to run tests, confidentially, free of charge.

THE JEFFREY MANUFACTURING COMPANY
824-99 North Fourth St., Columbus 16, Ohio
ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

When **TRAMP IRON** *calls the* **TUNE**

SAVES OVER

$500 per month!

Tramp Iron called the tune at Mercury Records Corp., Chicago, with broken dies, marred molds, scratched records. Dings Perma-Plates stopped tramp iron cold . . . prevented damage to costly equipment.

CALL FOR

Perma-Plate

The Most Powerful Permanent Magnet

Modern magnetic protection can save money for you! Install Perma-Plate magnets in chutes, ducts, pipes, over conveyors . . . tremendous magnetic power insures maximum iron removal . . . protects machinery, keeps products iron-free, prevents iron sparked fires and explosions. Non-electric . . . no operating cost, no maintenance, equally effective for wet or dry material, weatherproof. Advanced design; lightweight; easy to install. Write for Bulletin, and ask for your free, 1¼" x 1¼" Alnico horseshoe magnet (regularly priced at $1.00).

Magnetic permanency guaranteed for life of installation.

DINGS MAGNETIC SEPARATOR CO.
4730 WisW. McGeogh Ave. Milwaukee 14, Wis.
EST. 1899

Dings
"HIGH INTENSITY"

INDUSTRIAL NOTES

E. I. du Pont de Nemours & Co., Wilmington, has issued a quarterly statement of consolidated income. Their net income for the nine months ended Sept. 30 was $101,570,845.

Diamond Alkali Co., Cleveland, has formed a new technical service division headed by Walter C. Bates, manager, and Dr. George F. Rugar, assistant manager.

Monsanto Chemical Co., St. Louis, Mo., has appointed Thomas J. Martin branch sales manager at Detroit for their plastics division. Jack W. Porte has succeeded Mr. Martin as branch sales manager at St. Louis.

Ivan Bloch and Associates, Industrial Consultants, Portland, Ore., has been formed to serve industries desirous of analyzing potentials of establishment in Oregon, Washington, Idaho, Montana and Alaska.

National Aluminate Corp., Chicago, has opened a warehouse and office in Philadelphia headed by A. H. Webber.

Sonic Research Corp., Boston, has been formed to investigate various possible applications of high intensity sound to industrial processes. Engineering personnel consists at present of Caperton B. Horsley, Gordon C. Seavey, Donald L. Macnab and Alan A. Smith.

Mathieson Chemical Corp., New York, has named Harry P. Smith vice president and director of sales. His headquarters are in New York.

A. B. Farquhar Co. has named A. H. Dill their western district manager.

Carwin Co., North Haven, Conn., has appointed Richard Kithil vice president in charge of sales.

Raybestos-Manhattan, Inc., Passaic, N. J., has completed a warehouse and office in Los Angeles to service and stock rubber goods and packings for southern California.

Union Carbide & Carbon Corp., New York, will build three new plants in the Marietta, Ohio, area.

Tennessee Products & Chemical Corp. has appointed Stephen P. Kelly, manager, chemical sales division. Harrison

for • SPRAYING • WASHING • RINSING • COOLING • AIR CONDITIONING

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for Bulletin N-616.

YARWAY SPRAY NOZZLES

YARNALL-WARING COMPANY
137 Mermaid Avenue, Philadelphia 18, Pa.

IS YOUR CONTINUOUS FILTRATION *Really* CONTINUOUS?

If you are bothered by costly slow-downs due to filter cloth blinding—or if production stops completely while you change a blinded cloth or a cloth that's worn out by the scraper—you'll find the best solution is the FEinc continuous (*really* continuous) rotary vacuum filter.

The FEinc exclusive String Discharge neatly handles cakes as thin as 1/16 in. with no limitation on thickness, ranging from "impossible" slimes to matty, fibrous cakes. It does away with scrapers, wire-winding, and blow-back, hence eliminates smearing, and gives clothes longer life.

Then there's the FEinc Compression Mechanism that removes 2-6% more moisture and reduces vacuum requirements. And the submergence type washing mechanism that washes cakes down to unbelievable purity. Other features that can be engineered to your needs at reasonable cost include drum-dryer combinations, scoring devices for feeding cake to continuous dryers, repuddling mechanisms.

FILTRATION ENGINEERS INC.

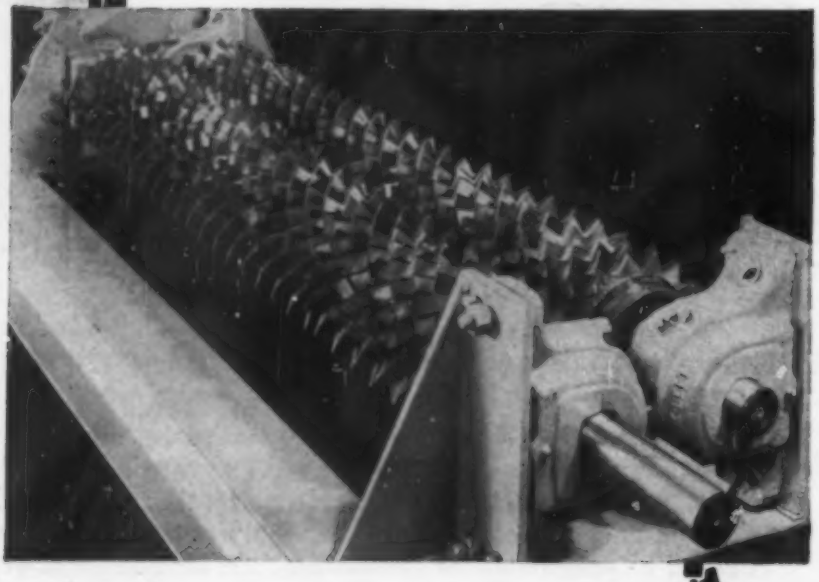
155 Oraton Street Newark 4, N. J.

Write for Bulletin 101, or ask for a free test on your slurry.

12

* STOCK RECLAIMING

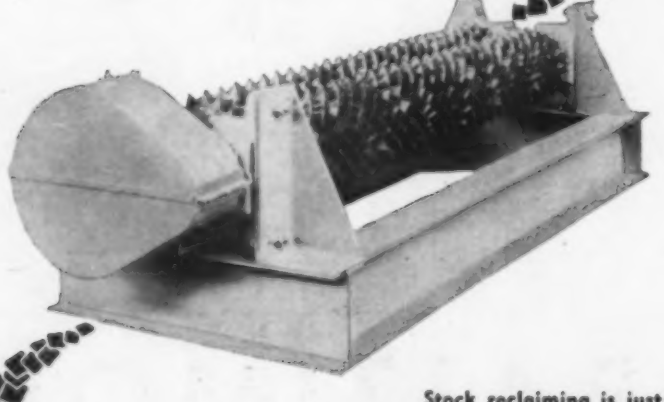
. . . MADE TO ORDER



TO streamline mastic floor tile production by reclaiming scrap—that's the job this special 62" Saw-Tooth Crusher was designed to do.

Installed at the end of the production line, it breaks up the selvage as well as the rejects . . . for reprocessing. It assures uninterrupted production on a continuous ribbon of stock 60" wide.

S-W Saw-Tooth Crushers are outstanding for preliminary stock reduction in sheet, slab, or cake form — where high capacity, low power, and minimum fines are important.



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SPROUT WALDRON Manufacturing Engineers

Stock reclaiming is just another field in which the "ADAPTION-EERED" approach proves successful. For resultful recommendations on your processing operations, contact Sprout, Waldron & Company, Muncy, Pa.

P. Weeks has been appointed assistant manager.

J. E. Lonergan Co., Philadelphia, has appointed Energy Control Co., Inc., as general representatives in the New York Metropolitan area, southern Connecticut and the Hudson Valley to the Canadian border.

Portland Cement Association, Chicago, has appointed Fred R. McComb district engineer of the Minneapolis office.

Sharp & Dohme, Philadelphia, has named Russel J. Muckle as export sales manager. He succeeds Con M. Hewitt who has been named director of marketing in the domestic sales division.

Jessop Steel Co., Washington, Pa., has made Frank B. Rackley vice president in charge of sales. Curtis A. Gordon has been made vice president in charge of operations.

Specialized Instruments Corp., Belmont, Calif., has named Philip F. Scofield chief engineer.

Watson-Stillman Co., Roselle, N. J., has appointed J. T. Gillespie, Jr., sales manager.

Emulsol Corp., Chicago, has appointed the Charles Albert Smith Co., Ltd., Ontario, as its sales representative for Ontario, Quebec and the Maritimes.

Kennametal Inc., Latrobe, Pa., has appointed Carroll Edgar as a representative in the Seattle area. William L. Chambers, application engineer, has been transferred from the midwestern district to the Pittsburgh district office.

Rayonier Inc., New York, has elected George E. Warren a director.

Illinois Electric Porcelain Co., Macomb, Ill., has appointed D. D. Pittman its sales representative in Wisconsin, Minnesota and Iowa, and the northern peninsula of Michigan.

R. S. Aries & Associates, New York, has added Emile A. Aries to their staff as manager of the overseas division.

Chemical Development Corp., Cambridge, is moving its process development and manufacturing operations to Danversport, Mass., from Cambridge. They have built a new plant to provide for expanded operations.

Sprout-Waldron and Co., Muncy, Pa., has sent William J. Geist, manager of the tobacco machinery division, to Caracas, Venezuela, to supervise the

Heat at the HEART of the Metal and Save 40% of Your Fuel . . .

Kemp heat is not outside, fighting its way through a heavy pot or vessel; but inside passing rapidly through shells of thin metal.

Where waxes, resins and fats are to be melted, processed and blended . . . in grease blending . . . and in the melting of salts, Kemp Immersion Heating equipment promotes superior efficiencies in heat transfer . . . with uniform temperatures throughout the pot or vessel . . . as hot at the top as at the bottom.

We can't tell you the whole story here . . . but any Kemp representative will be glad to. There is one not far from you . . . drop us a line if you are interested in saving up to 40% in solution heating costs or send for the Kemp Bulletin No. IE-11 on Immersion Heating.

10-Burner Kemp Immersion Heating Pot, with Drain Valve for change of heated material from time to time

The C. M. Kemp Manufacturing Co.
405 East Oliver Street
Baltimore 2, Maryland

Please send me your NEW Bulletin No. IE-11 on Immersion Heating. ☐

Please send a Kemp representative in to see me. ☐

Name.....

Company.....

Street.....

City..... Zone.....

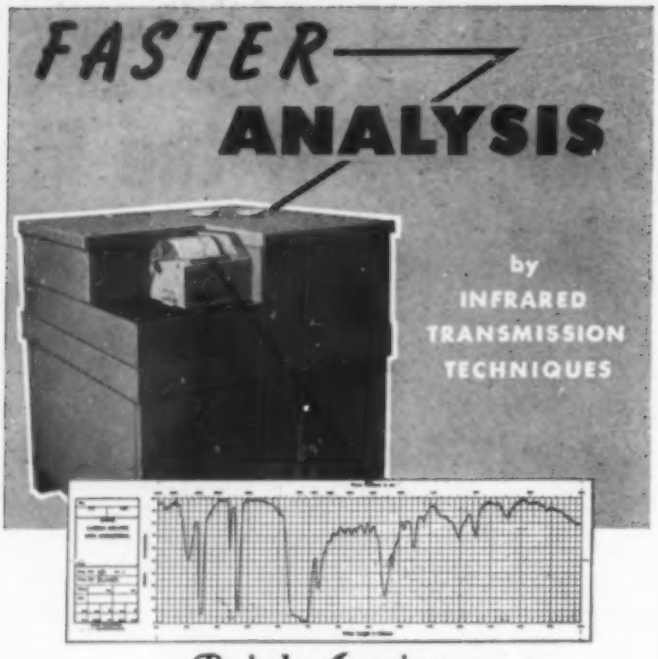
State.....

GCE-12

KEMP of BALTIMORE

The C. M. KEMP Manufacturing Co., 405 East Oliver Street, Baltimore 2, Maryland

PRECISION CARBURETORS • BURNERS FOR INDUSTRIAL HEAT CONTROL • FIRE-CHECKS AND OTHER SAFETY DEVICES ATMOSPHERE GENERATORS • INERT GAS PRODUCERS • ADSORPTIVE DRYER SYSTEMS FOR PROCESS CONTROL



Baird Associates

INFRARED RECORDING SPECTROPHOTOMETER

IN APPROXIMATELY 12 MINUTES

. . . infrared spectrograms are automatically recorded in direct percent transmission with linear wavelength scale, giving accurate analysis, for quality control or for solution of general chemical problems.

GASES, LIQUIDS, and SOLIDS

. . . can be analyzed with equal rapidity and accuracy. The infrared technique is particularly valuable in analyzing the more complicated organic compounds (see spectrogram above of cholesterol in carbon disulfide). In the determination of spacial isomers, where conventional methods are troublesome and time-consuming, infrared methods are fast and exact.

DIFFERENTIAL ANALYSIS

. . . by means of the exclusive double-beam principle employed in the Baird Associates Infrared Spectrophotometer . . . greatly simplifies analysis of mixtures for slight impurities and for variation from a standard. In fact, complex analyses are reduced, by this automatic instrument, to routine tasks for a laboratory technician.

SPECIFICATIONS

Spectral Range — 2 to 16 microns (linear)
Precision —
Transmission ±1%
Wavelength ± 0.02 microns
Chart Size — Linear scales:
Transmission 5½ in.
Wavelength 17½ in.
Recording Speed — 12 minutes for complete spectrogram

For detailed description and specifications of the Baird Associates Infrared Spectrophotometer, request Bulletin XXX. Baird Associates will gladly confer with you regarding the application of this instrument to your needs.

Baird Associates, Inc.
INDUSTRIAL PHYSICISTS
33 University Road Cambridge 38, Massachusetts

installation of a complete tobacco leaf processing system for one of the major cigarette manufacturers in South America.

Market Forge Co., Everett, Mass., has appointed Robert P. Rudy district manager of the New York area for their materials handling division.

Beaumont Birch Co., Philadelphia, Pa., has organized a chemical materials handling division.

Clayton Manufacturing Co., El Monte, Calif., has appointed Ray Sanders as assistant general sales manager.

Rapids-Standard Co., Inc., Grand Rapids, Mich., has appointed Wesley Aves & Associates, Grand Rapids, as their advertising agency.

Institute of Textile Technology, Charlottesville, Va., held a meeting of technical directors of a number of member mills to discuss problems common to textile manufacturing plants and to hear descriptions of work being done at the Institute.

American Gas Association at a convention in Atlantic City elected the following men as officers of their Industrial and Commercial Gas Section: chairman, Bernard T. Franck; vice chairman, D. W. Reeves.

Globe Steel Tubes Co., Milwaukee, Wis., has made Lee Mullen vice president in charge of sales.

Fairbanks Co. has made Edmund T. Flanagan manager of regional sales in addition to his present position as manager of New York sales division.

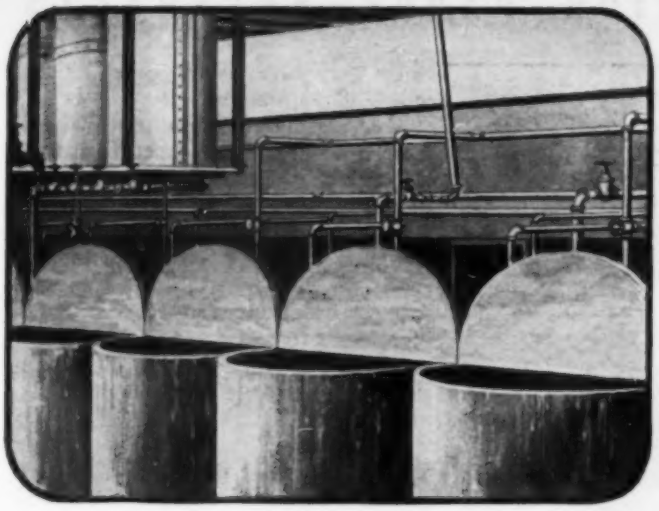
Dampney Company of America, Boston, has appointed R. J. Denton Co., Syracuse, N. Y., as distributor of their protective coatings in the Syracuse area.

H. K. Ferguson Co., Cleveland, Ohio, has established a new sales office in Chicago.

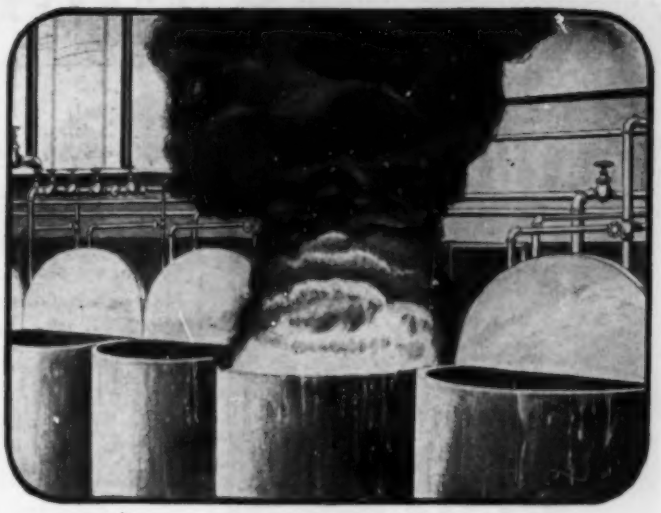
Joshua Hendy Corp., Ampere, N. J., has reopened the Buffalo branch office of its Crocker-Wheeler Electric Mfg. Co., division.

Hungerford & Terry, Inc., Clayton, N. J., has appointed William M. Longshore as its Houston, Tex., representative.

Hamilton-Thomas Corp., Hamilton, Ohio, has been formed to operate Economy Pumps, Inc., Klipfel Mfg. Co. and Liberty Planers, Inc.



If agitators or mixers—



burst into flames—

SMOTHER THE FIRE

THE *Kidde* WAY!

Fire in agitators or mixers handling flammable liquids can spread beyond control in a matter of seconds! Be ready to act when the fire *starts*—with a *Kidde** Carbon Dioxide System.

Carbon dioxide (CO_2) from Kidde Nozzles—aimed straight at the danger spot—pours into tanks, screens hatches to cut off the flames' supply of oxygen. Fire can be extinguished quickly—*without* diluting or contaminating your mixes. No corrosion of metal parts—no after-fire mess to clean up.

Ask one of our representatives for full details on *Kidde* Systems.

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Write for Bulletin 101
ROY E. ROTH COMPANY
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Rock Island, Illinois

CONVENTION PAPER ABSTRACTS

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MANAGEMENT

Employees Are People

J. R. McNulty

IT IS not so much the arbitrary decision which leads to the employee's feeling of "not belonging," but the fact that the employee is not consulted and is not apprised of the reasons for the decision. The roustabout doesn't expect to attend the board of directors' meetings, but he does want to know what is happening in his company before he reads about it in a newspaper —and he deserves to know the "whys" of the decision affecting him.

John R. McNulty, Ohio Oil Co., before American Petroleum Institute, Chicago, Nov. 9, 1948.

RUBBER

Reclaim Problems

F. L. Kilbourne, Jr.

INTRODUCTION of synthetic rubber made necessary many changes in recipes used for making tires, inner tubes, and many other rubber articles and, likewise, many changes were needed in the technology of reclaiming rubber from worn-out tires and other forms of scrap.

Salvaging synthetic rubber is inherently more difficult because the man-made material reacts much less rapidly to heat and the chemicals employed to reclaim the natural product.

During the war, this difference between the two kinds of rubber was used in our laboratory to reveal in which part of their tires the Germans were using their synthetic rubber and where they were placing their limited supply of natural rubber.

The resistance of synthetic rubber scrap to older reclaiming processes and formulas is so great that chemists have found it necessary to search for and discover stronger softeners. These compounds, although more expensive than other oils, make it possible to soften synthetic scrap to the same degree as was formerly possible with natural rubber, using conventional oils such as pine tar, coal-tar naphtha, or asphalt.

Reclaiming is complicated further by the fact that many scrap rubber articles are composed in part of natural rubber and in part of synthetic rubber. The techniques of rubber salvage have been successfully adapted, so that today reclaimed rubber is generally found to be fully as useful as the old natural rubber reclaim.

Tests made in passenger car tires indicate that the synthetic product is practically equivalent to the natural rubber reclaim of a few years ago. In some compounds, the synthetic product is superior to the natural rubber reclaim, while in others the reverse is true.

Butyl rubber, the material employed widely for inner tubes, is a fly in the ointment, contaminating scrap so that it cannot be processed into a product of any value.

F. L. Kilbourne, Jr., Xylos Rubber Co., before Rubber Division, American Chemical Society, Detroit, Nov. 9, 1948.

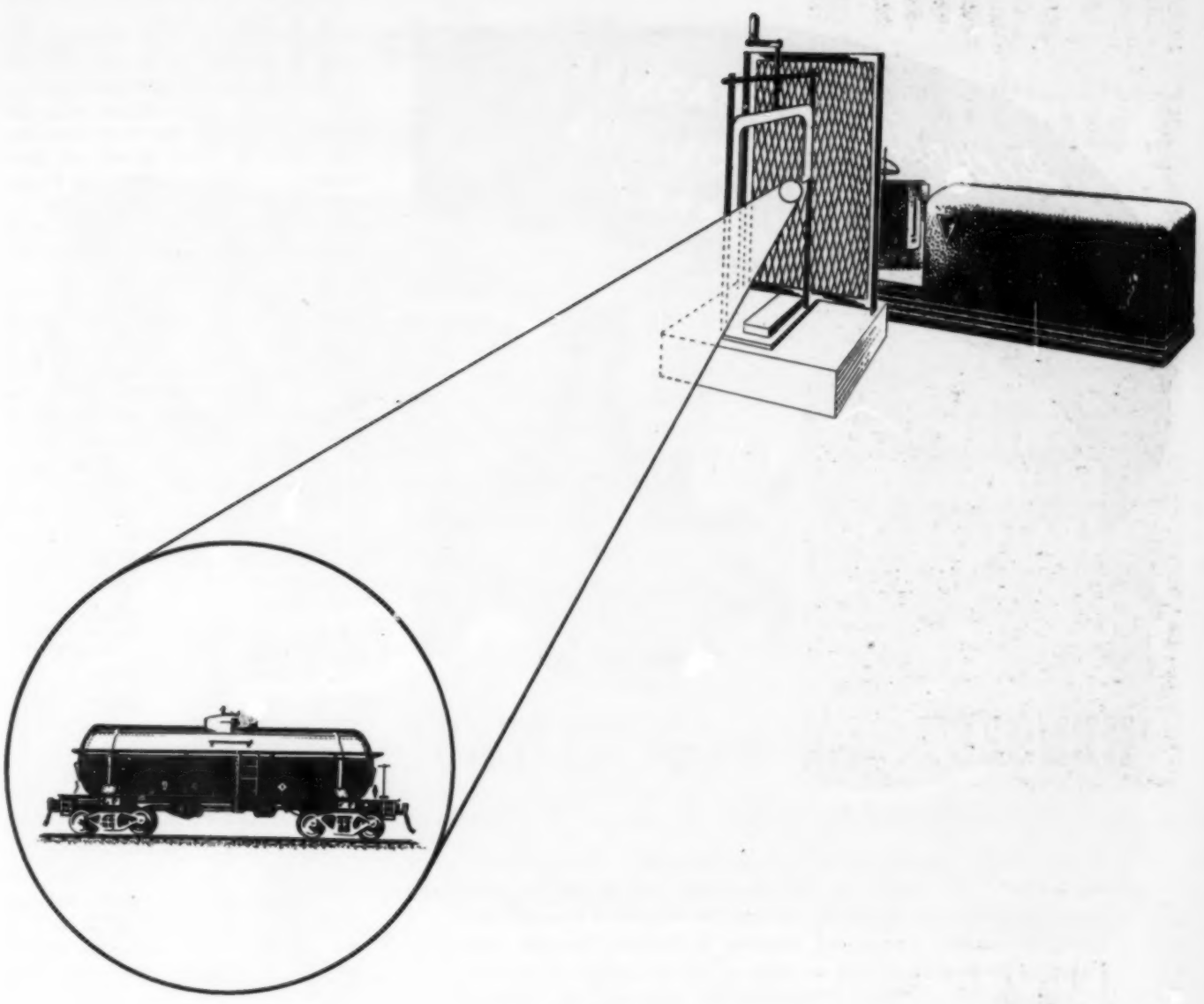
CORROSION

Anaerobic Corrosion

J. B. Hunter

INCREASING evidence is being found that anaerobic corrosion of the external surface of pipelines is a serious problem in widely scattered localities.

Anaerobic corrosion, according to the latest concept, is caused by a specific type of bacteria which are active only in environments free of oxygen (anaerobic). Other factors which affect the action of the bacteria are moisture content of the soil, the alkalinity or environmental pH, abundance of organic matter, and presence of salts required as nutrients for growth of the bacteria. One of the theories concerning the mechanism of anaerobic corrosion is that the principal action of the bacteria is to depolarize the pipe by removal of cathodic hydrogen normally present when iron is in contact with water. The bacteria make use of the sulphate present in the soil adjacent to the pipe to oxidize the ca-



do your requirements call for a better grade caustic soda?

If pure, uniform caustic soda is a desirable factor in your production plans, it will pay you to get acquainted with Wyandotte Caustic Soda.

Produced by the Mercury Cell method, this exceptionally high-grade chemical is ready for use, as prepared, without further processing. That's an important advantage! Its purity and uniformity are not dependent upon the efficiency of a purification system.

We have recently completed additional manufacturing facilities which have greatly expanded our production of Mercury Cell Caustic.

If your particular requirements include quality caustic soda, or any of the chemicals listed below, why not ask Wyandotte?

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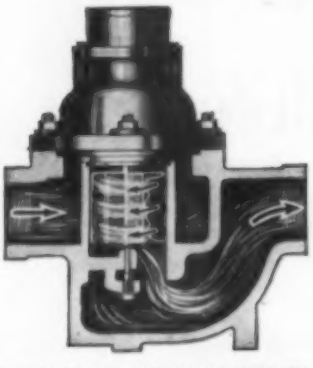
can be calibrated to suit your specific needs.

These simple rugged meters do an outstanding job of measuring boiler feed water, boiler blowdown, condensate, free-running chemicals, and other "hard-to-measure" liquids. The straight reading horizontal register accurately records any liquid at high or low flow — high or low pressure — on centrifugal or reciprocating pumps. They can be installed right in the line . . . no additional supports are needed.



If you have a liquid measuring problem that demands accuracy in readings of gallons, pounds, or cubic feet, consider the reliable Henszey Feed Water Meter. Ask for details.

SIMPLICITY WITH ACCURACY

Liquid enters the measuring chamber tangentially, spinning in the chamber as it passes through, forming a vortex. Each unit of liquid passing through this chamber makes the same number of revolutions. A vane placed in the liquid imparts this rotation to the calibrated register. A minimum of working parts without close clearances.

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thodic hydrogen. The sulphate, in turn, is reduced to sulphide—which can be detected as hydrogen sulphide. This sulphide reacts further with the ferrous iron of the pipe to produce ferrous sulphide. Thus growth of these bacteria is accompanied by the formation of hydrogen sulphide, and anaerobic corrosion is characterized by the presence of ferrous sulphide in the products of corrosion.

The results of study indicate that control of the alkalinity of the soil adjacent to a pipeline could be used to inhibit anaerobic corrosion. A high alkaline environment inactivates, but does not destroy, the sulphate-reducing bacteria which cause this corrosion. To prevent reactivation of the bacteria, an alkalinity greater than 9.0 to 9.5 pH must be maintained. Such control of the alkalinity of the soil might be accomplished in the field by electrical or chemical means.

J. B. Hunter, H. F. McConomy and R. F. Weston, Atlantic Refining Co., before American Petroleum Institute, Chicago, Nov. 8, 1948.

FERTILIZER

Western Forecast

R. E. Bell

IF CHEAP byproduct sulphuric acid is available in the western states, the concentrated superphosphate fertilizer produced at a western point will be able to reach the large midwestern markets at a slightly lower cost than Florida treble superphosphate.

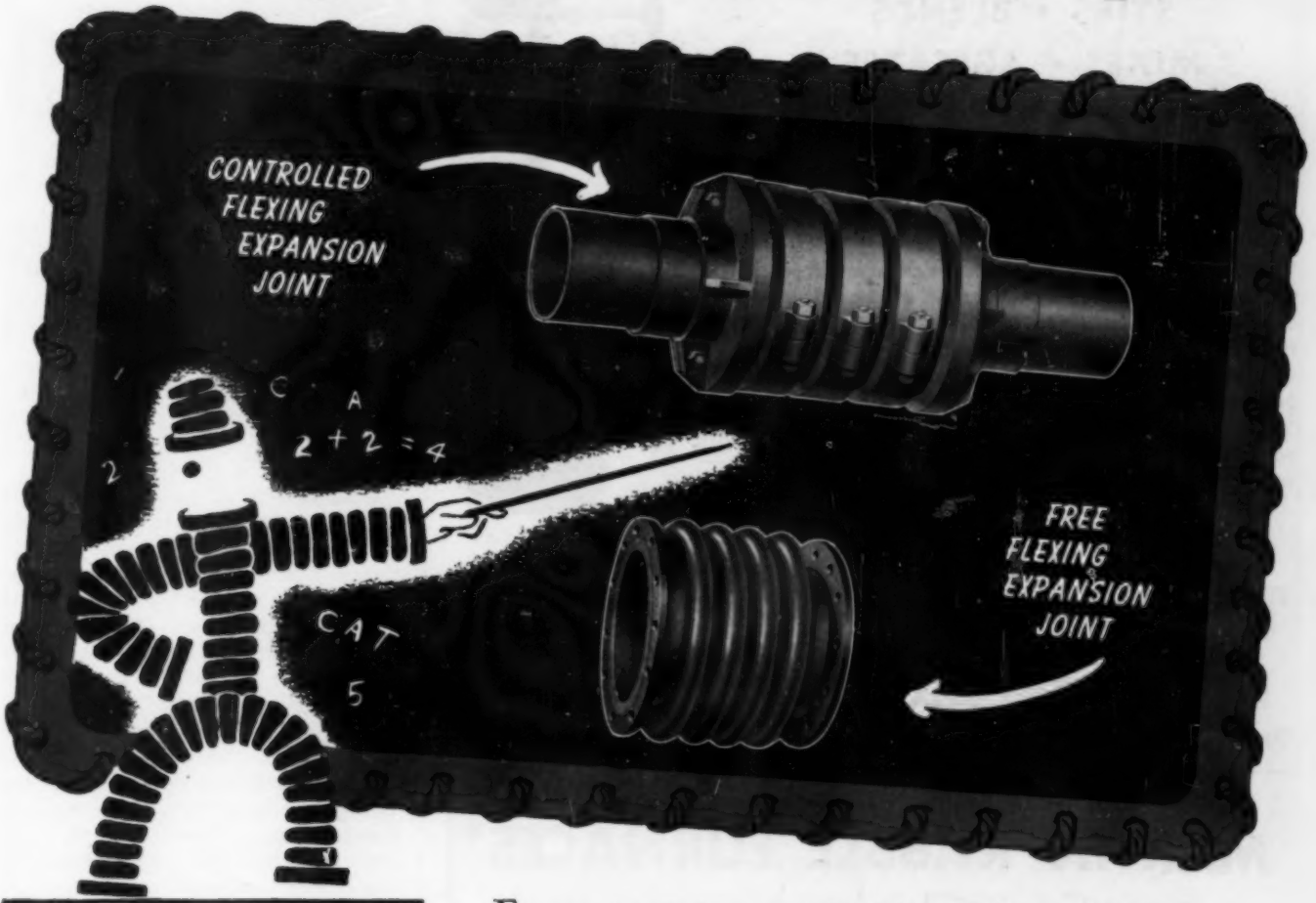
Consumption of phosphates in 1946 was only about half of the estimated need in the western area. The recent increase in fertilizer use in the West has partly been stimulated by high price levels. However, it has been associated with an experience of decreased general production where fertilizers have not been employed.

The rise in western fertilizer consumption has led to some odd situations. Western fertilizer producers could not meet the rising demand and fertilizer has been imported from the East. Actually some fertilizer originating in Florida, processed at Baltimore, and shipped to mixing plants in Portland, Ore., finds its way into the markets of Idaho and Montana.

Two of the most important requirements for fertilizer production are available in the West. These are the presence of large deposits of phosphate rock and a satisfactory supply of power and coal. Some 60 percent of the nation's phosphate rock lies in Idaho, Wyoming, Utah, and Montana. So far these deposits are virtually undeveloped.

It is evident that the alternatives

Let CMH simplify expansion control for you



CMH FREE-FLEXING EXPANSION JOINTS for pressures to 30 psi.; temperatures to 1400° F. Sizes to 24" I.D. Flanged or welding ends.

CMH CONTROLLED-FLEXING EXPANSION JOINTS with precision mated control rings for pressures to 300 psi.; temperatures to 1400° F. Sizes to 24" I.D. Flanged or welding ends.

SPECIAL CMH EXPANSION JOINTS for higher pressures can be furnished. Recommendations will be made on receipt of installation details.

For most installations, expansion joint selection need not be a complicated task. CMH has reduced the expansion joint selection problem to a matter of charts from which the joints necessary to meet your requirements may be selected quickly and easily. For unusual installations CMH offers its "Engineered Application Service" in which competent piping specialists will analyze your problems and make recommendations.

Whether your requirements are "run of the mine" or "one in a million" . . . for a new installation or replacement of obsolete equipment . . . CMH will make it easier for you to get the *right* expansion joint.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

"the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

The charts mentioned above plus additional application data are presented in Bulletin EJ-47A. Write for copy.

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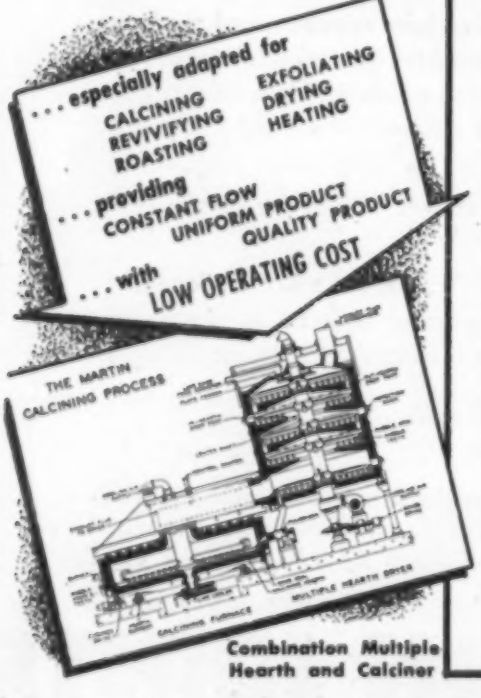
MARTIN RABBLE FURNACES*



Combination Multiple Hearth and Calciner

The Martin Multiple Hearth Furnace is adapted for continuous process rabbling with mass temperatures up to 1800° F. The furnace can be "zoned" for closer control.

The Rotating Hearth Furnace is designed for continuous rabbling, carrying material bed temperatures 1800° F and higher. Special designs can be provided for rabbling up to 2500° F. The unit is especially adapted for reburning of lime, high temperature rabbling of pigments and similar materials where a dust condition would otherwise be troublesome.

This Martin Furnace is capable of considerable flexibility. Why not look into the merits of this furnace for your processing?

*Patents and Patents Pending

Martin Furnace Division
MORSE BOULGER DESTRUCTOR CO.
211-A East 42nd St. New York 17, N. Y.

which deserve the most consideration are use of the sulphuric acid process to make superphosphate at one of the smelters such as Salt Lake City, Anaconda, or in the Coeur d'Alene district in northern Idaho, an electric furnace plant located near the phosphate mines, or a blast furnace plant located near the phosphate mines.

R. E. Bell, Bureau of Land Management, before American Institute of Chemical Engineers, New York, Nov. 10, 1948.

INTERNATIONAL

Fear of the Machine

C. H. Greenewalt

As WE look to the future it seems to me that the opportunities and responsibilities of our educational institutions are assuming greater and more significant proportions than has ever been the case in the past.

The growth of technology and industry has been due to the fact that people are preoccupied with material things. They want comfort; they want leisure; they want improved living in a material sense—and it is those desires for material trappings that have provided the prod which has produced technology's great growth.

However, we are all prone to forget that there has been no great advance in science and technology that has not brought with it a social change—no forward step in catering to our material comforts that has not also changed the spiritual order of our existence.

Advances in transportation have shrunk our globe. We have developed methods of communication that can send the spoken word around this earth of ours in a small fraction of a second. We have given ourselves more leisure. We have created a great industrial civilization, a civilization made possible by the growth of technology —from microscopic proportions at the beginning of our country's history to the giant stature it has today.

Fear of the machine has been with us since its first development. But technology has created other conflicts. The most serious of these is between the owners of our tools and those who use them. In large parts of the world this conflict has produced communistic ideologies endangering world security. The goal of seeing how much we can produce from the tools has given way to a struggle over who shall own the tools; whether the many, as in this country, or a government dominated by the few, as in the opposite philosophy. This is a futile battle in which everyone is the loser.

These fears and conflicts we can deal with, given the time and the willingness to do so. We have dealt with

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Centrifugally Cast Pipe

is Better Pipe

Centrifugal castings are superior castings. The metal is sounder, finer-grained, more uniform. It is free of gas pockets, blow holes and other defects often difficult to keep out of static castings. Tensile strength is close to that of rolled or hot-forged alloy steel. Dimensions are accurate, usually requiring less machining and finishing and thus speeding production.

If you require *extra* qualities in your high alloy pipe, investigate DURASPUN Centrifugally Cast Pipe. We can produce it in OD ranging from 2½" to 24" and in lengths up to 15' according to diameter. Our experience in the field of centrifugal high alloy castings dates back to 1931. Our experience in the field of static high alloy casting goes back to 1922. We can give you good service.

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them in this country more successfully than has been the case anywhere else in the world because we have learned to value peace, to trust our fellow man, to maintain our philosophies of incentive and opportunity, and to know that by cooperation toward a given goal we can accomplish miracles for all.

The great danger is brought about by inability of less developed peoples to understand this simple fact. It is intensified by their apparent willingness to resort to force and terrorism to establish their philosophy.

It is a pitiful commentary on man's spiritual progress that his brains and abilities have developed technologies which may be turned toward his destruction.

C. H. Greenewalt, E. I du Pont de Nemours & Co., at the Drexel Institute of Technology Founder's Medal Presentation, Philadelphia, Oct. 18, 1948.

GLASS

Materials Handling

P. M. Hunt

SINCE 1940 the cost of raw materials in the glass industry has risen astronomically. Increases in cost and scarcity of manpower have presented a complex problem. Hence, materials handling equipment has been of critical importance.

There was a time, not so long ago, when sand, soda ash and lime were shoveled by hand. Now tons are swept out with one movement. Components were formerly weighed out and mixed with a hoe. Now an automatic set of scales over a traveling belt does the job, with the aid of a large revolving mixer driven by electricity. Originally the batch went to the melting furnace in wheel-barrows. Now the batch is dumped into huge buckets suspended on an overhead mono-rail. Directly over the furnace intake the bottom of the bucket is opened and a screw conveyor feeds the furnace at the speed desired. Bottles are transferred from bottle machines to the annealing oven by gadgets and conveyors peculiar to the industry. Glass is carried through the annealing oven on a wire mesh belt. Power-driven conveyors have been installed in the selecting room. Made-up shipping cases come from a balcony on conveyors. Photoelectric cells and electronics do a better job of finding certain defects than is visually possible.

In the factory building proper an overhead crane speeds up any repairs or machine changes. In the corrugated paper plant, an overhead crane stores the rolls in considerable height and delivers them to the corrugating

"FLOATING POWER"

in Taylor's new Mercury Manometer!

TAYLOR'S new "1500" Mercury Manometer is ready to step in wherever you need something *better* than present differential pressure measuring instruments. "Floating Power" is made possible by large float and long travel. This great power is transmitted by a precision-ground shaft and *Teflon bearings which "float" the power through to the pen. Other important features:

1. HIGH ACCURACY. *Inherent straight-line calibration* gives faithful accuracy at every point on the chart.

2. POSITIVE ACTUATION—High energy output. **(a)** *Big 3¼" float.* **(b)** *Long travel of float*—1". **(c)** *Simple lever system.* Stainless steel lever arm fastened to flat of pressure-tight bearing shaft with screw. **(d)** *Teflon in pressure-tight bearing surfaces* assures efficient use of power because: Teflon bearings, micro-finished shaft, silicone lubricant give unprecedented performance—leakless, and negligible friction under high working pressures. Union coupling on bearing housing prevents distortion of bearing and binding of shaft. **(e)** *Jewelled thrust bearing.*

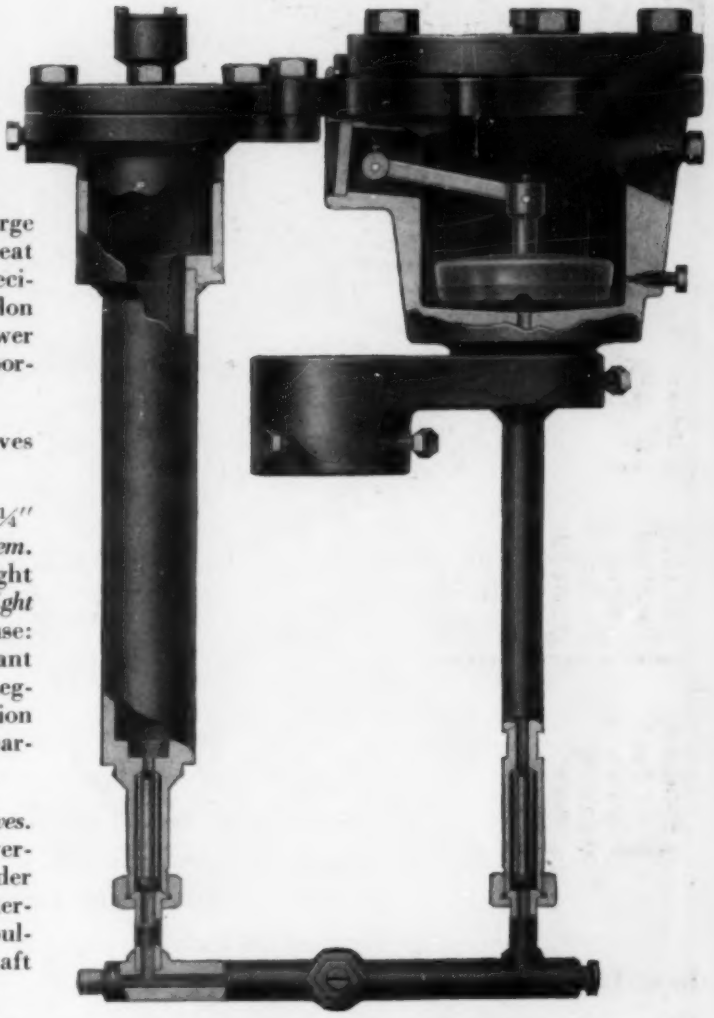
3. DEPENDABLE PERFORMANCE. (a) *Submerged check valves.* Metal-to-metal seats; Positive shut-off in event of overrange. **(b)** *Unique damping valve* easily adjusted under full pressure without leakage. **(c)** *Ample capacity* in mercury chambers to accommodate effects of surges or pulsating flows. **(d)** *Teflon holds pressure,* yet allows shaft to rotate freely and assure long, dependable service.

4. GREAT ADAPTABILITY. (a) *Six interchangeable range tubes:* 10", 20", 50", 100", 200", and 400" of water. **(b)** *Tubes can be easily changed* in field without piping alterations. **(c)** *Both side and top* pressure connections. **(d)** *Two Manometers* can be mounted on back of single case for recording two Flows or for Ratio-Flow control.

5. EASE OF MAINTENANCE. (a) *Low pressure chamber* cover gives easy access to float and lever arm mechanisms during calibration. **(b)** *Entire pressure-tight bearing* easily and economically replaced.

The "1500" results from closely coordinated, highly specialized work by our Research, Engineering, and Development departments. Write for Bulletin 98182, or ask your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

*Teflon—synthetic plastic used in bearing surfaces—conforms to stainless steel shaft. Also minimizes friction. Because Teflon is inert to most industrial chemicals, bearing surfaces are generally unaffected by corrosion.



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Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

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HOT FORGED STEEL AND STAINLESS STEEL UNIONS

STANDARD
1/8" TO 3"
Cold-Working Pressure up to 2,000 pounds.

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1/8" TO 2"
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The Catawissa seat design gives you a perfect seal for every installation -- even when the pipe is not properly aligned -- with its 55-degree angle on the female end to a ball on the male end!

HOT FORGED STEEL SWING CHECK VALVES.
ESPECIALLY ADAPTED FOR HIGH TEMPERATURE & HIGH PRESSURE SERVICE!
For boiler injection--engineered to outlast the boiler! Efficient, easily accessible!

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machines. Where corrugated partition strips were formerly assembled by hand, air-driven machines now do it. Fully automatic machines set up and glue the shipping cases.

Review the fundamentals of quality production at lowest possible cost: (1) Do you purchase raw materials from a reputable firm practicing a quality control program meeting your specifications? (2) Does delivery conform to your facilities for receiving? (3) Study unloading methods. Can it be done easier by use of fork trucks and pallets? Power conveyor? Magnets, vacuum or air? (4) How do you deliver to your storage or center of usage? Isn't it possible to reduce manpower by utilizing some commercial piece of equipment? If not, could some firm build what you need? (5) Is storage handled in the most economical manner? (6) Is delivery from storage or receiving to the assembly or filling or packaging center coordinated with production?

Paul M. Hunt, Owens-Illinois Glass Co., before the Western Packaging Exposition, San Francisco, Aug. 12, 1948.

PETROLEUM

Chemicals, Competition And New Construction

Marcus Sittenfield

MUSHROOMING use of petroleum as a chemical raw material has brought problems to the chemical industry. Where it used to be that a given chemical was produced from only one raw material, say coal, a chemical company now has alternate sources of raw materials, coal and petroleum.

Formerly, agricultural products, coal and petroleum each served as a relatively distinct source of raw materials for conversion into specific chemicals. Such products as toluene, vinyl resins, and others have been derived from coal. Agricultural products were the source of such chemicals as ethyl alcohol, glycerine, acetic acid, and others. Today, these and many other products are being made from petroleum hydrocarbons.

There are a number of factors which are responsible for the increasing use of petroleum products in producing organic chemicals. These are the reactivity of petroleum hydrocarbons, the apparently unlimited supply of petroleum products, the growing necessity for petroleum companies to utilize the various byproducts of refining operations to the fullest, the intensive research program that has been carried out over the past years on the utilization of these materials, and the development of new and improved separation processes.

The petroleum chemical industry is

Nobody throws away Stainless Steel

Stainless steel *lasts*. Allegheny Metal stays bright and strong —gives lifetime service—under conditions of corrosion, heat and wear that send lesser metals to the junk-pile in a few years, or perhaps only months. Wherever a superior metal will give you advantage, you'll find it cheapest in the long run to use Allegheny Metal, the time-tested stainless steel.

Complete technical and fabricating data—engineering help, too—yours for the asking.

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The Nation's Leading Producer of Stainless Steel in All Forms

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Now You Can Test Viscosity
as easily as
Temperature or Density

by using a

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In just 30 seconds anyone can test viscosity with the Brookfield Viscometer — no special skills or technical training needed. Readings can be taken in lab or plant with equal ease, as instrument is portable and needs only connection to an electrical outlet. Now you can match laboratory standards in the plant and be sure of uniform results.

Send for our new 8-page illustrated Bulletin which gives full information on the instrument and its applications.

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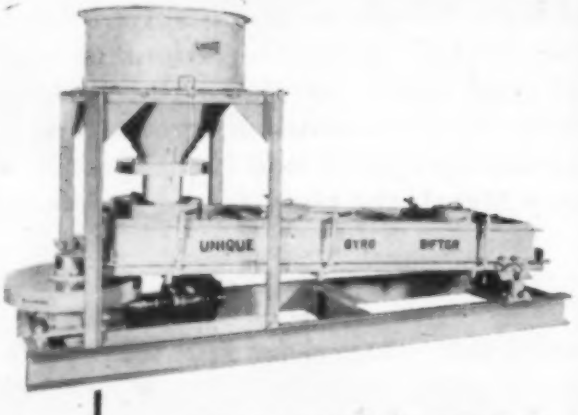
Capacities To Your Requirements
GYRO-SIFTER
Uniform Sizing of All Materials



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not only a large and growing industry, but it is also economically complicated. In selecting a site for a petrochemical plant the usual factors of labor, land, taxes and utilities must be studied, but also the selection of the product to be manufactured, a study of its uses, the location of its major users, determination of the processes to be used in its manufacture, and a study of the raw materials to be used.

Until now the result of such studies has been a tremendous growth in the production of chemicals in the Southwest, production based on petroleum raw materials. One factor which may curtail additional expansion in this area is the recent Supreme Court ruling outlawing basing point pricing systems. The change in freight rates resulting from this decision may add up to 15 percent to the cost of building a plant in an area such as the Southwest. As a consequence, it may be considered more economical to build plants in local consuming areas close to sources of steel, shipping raw materials to them rather than build a plant at the source of the raw material.

Marcus Sittenfield, before American Institute of Chemical Engineers, New York, Nov. 10, 1948.

PLASTICS

Plant Location

C. O. Hoyer

THERE will not be any migration of the plants producing plastic molding powders and other resin forms until users, molders and other fabricators, grow in new areas. Freight rates, the ability to give customer service, and the maintenance of low inventories by manufacturer and consumer are the basic reasons.

Freight rates afford a two-sided picture. The raw material cost is 60 to 90 percent of the cost of the finished molding powder, sheet, film, resin, or adhesive. Consequently, extremely high freight costs, by reason of being a great distance from the source of necessary materials, would be extremely uneconomical.

On the other hand, freight costs on finished plastics molding materials, the requirement to give service, and the need for low inventories override freight costs on raw materials.

Polystyrene, for example, is available on today's market in more than a thousand colors, and our color laboratory can match eight quintillion colors, shades, and hues, all discernible to the human eye. Such a variation demands low finished product inventories. Added to that is the fact that customers are usually small organizations—thousands of them. Most of

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Can your product or production methods be improved by the use of chemically inert, high- and low-temperature-resistant materials? Then it's very likely that General Electric silicones are just what you are looking for.

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WANT TO KNOW MORE ABOUT G-E SILICONES? You can find out how these amazing materials may fit into your own production picture by simply contacting us. Chemical Department, General Electric Company, Pittsfield, Massachusetts.

GENERAL ELECTRIC

CD48-Q10

SILICONES for Industry

From this Mississippi River shipping terminal of Freeport Sulphur Company at Port Sulphur, Louisiana, Sulphur is shipped to Industry.

One of a series of Stories on Sulphur

BY RAIL and by water Sulphur shipments leave Gulf Coast ports bound for market. Where is the market for Sulphur? Everywhere we look around us. A hundred times a day we touch and use food, materials and articles in which Sulphur has played a part. Sulphur's markets are the countless industries which need its help.

THESE industries make use of the chemical properties of Sulphur to supply us with such products as rubber, paper, fertilizer, chemicals, rayon, petroleum products, steel, dyes, paints, explosives and textiles. And these are only a few of the products in which Sulphur is a key factor.

SOMETIMES Sulphur is used just as it comes from the mines. Often it is converted into Sulphur Dioxide or Sulphuric Acid before it goes to work. Usually its service is performed behind the scenes at some stage in the process and Sulphur does not appear in the final products—the products we buy in the stores.

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SULPHUR SERVES INDUSTRY

them live in a relatively small inventory basis and depend on the large manufacturer to make quick delivery in limited amounts. Therefore, nearness to the market and good transportation facilities are vitally important.

Monsanto's plastics plant at Springfield, Mass., is a good example of location near the market. It is in the heart of 60 percent of the plastics industry, which is now concentrated in New England, New York and New Jersey. Although an old plant, the location is evidently as good now as it was in 1904.

Another factor which causes some plastics plants to be near the consumer is the unstable nature of the materials. Adhesives, used in bonding such things as plywood, if not used soon after production, will solidify in their shipping containers. There isn't much choice in location for a plant producing these materials.

C. O. Hoyer, Monsanto Chemical Co., before American Institute of Chemical Engineers, New York, Nov. 10, 1948.

MEDICINE

Cold War

Karl Habel

SCIENCE may save years in its war on the common cold through a chemical method of virus identification now being developed at the National Institutes of Health.

Up to now, every cold virus determination has required the services of at least eight human guinea pigs. Obviously, this is a field in which effective chemical methods would make great strides possible in a short time, instead of requiring years and hundreds of human volunteers before even basic information could be obtained.

In work still in progress, and not yet published, researchers are now getting very encouraging results on just such a chemical approach to the presence of these common cold viruses. Much more basic work will be necessary, but to date there appears to be definite correlation between the chemical titer of a given virus sample and its ability to infect human volunteers.

Karl Habel, National Institutes of Health, before North Jersey Section, American Chemical Society, Nov. 8, 1948.

FOREIGN

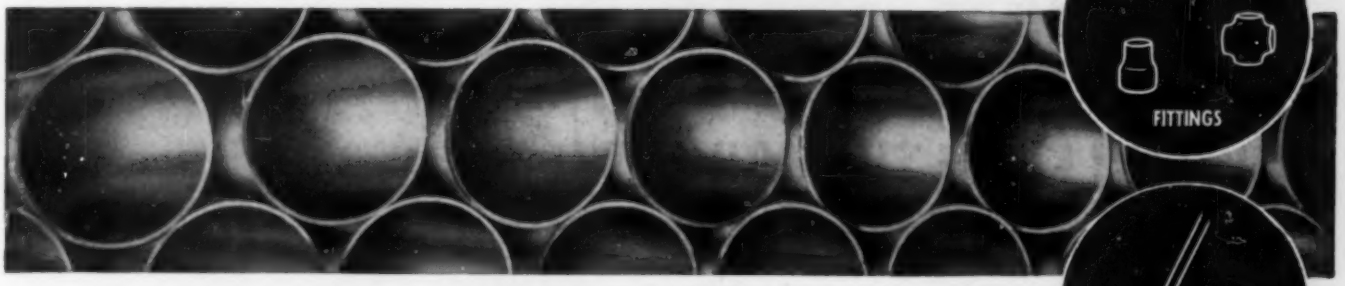
Dutch Trends

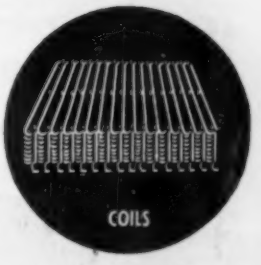
Robert S. Aries

SINCE the war, the average factory size of the chemical industry in the Netherlands has increased, the range of products has multiplied, and the

NEW

Carpenter Stainless Tubing No. 20 to Handle SULPHURIC ACID!





A new type of Stainless Tubing steps in to help in your fight against the costly results of corrosion. Its name is Carpenter Stainless Tubing No. 20 . . . the latest result of our constant research to make Stainless Tubing do more for you.

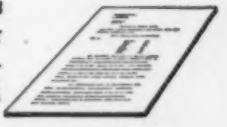
In the past, the alloy has been available only in the cast form, known as Durimet 20. Now that Carpenter has overcome the problem of producing this alloy in the wrought form, its usefulness in solving corrosion control problems has been greatly increased.

There are two general types of applications in which Carpenter Stainless Tubing No. 20 can provide new and increased economy. First, in processes where sulphuric acid solutions are present at various temperatures and in various concentrations. And second, in handling other highly corrosive acids and solutions where an extra margin of safety is required, over and above the corrosion resistance provided by other types of Stainless Steel.

Carpenter Stainless Tubing No. 20 is produced in standard sizes from ⅜" to 2⅜" O.D., and in standard pipe sizes up to 2". Your inquiries and orders for Carpenter Stainless Tubing No. 20 will receive prompt attention.

Corrosion Resistance and Physical Properties Data . . .

These data pages will give you useful information on the jobs that can be handled by Carpenter Stainless Tubing No. 20. For your copy, just drop us a note on your company letterhead, indicating your title, and ask for the Carpenter Stainless No. 20 Data Pages. We will be glad to put them in the mail for you.



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Carpenter Stainless Tubing No. 20 is also being produced in the forms of bar stock, wire and strip. For information, get in touch with The Carpenter Steel Company, 127 W. Bern Street, Reading, Pa.

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SCHNEIBLE

LIQUID-VAPOR INTIMATE CONTACT EQUIPMENT for DUST COLLECTION ABSORPTION CONDENSATION AND TEMPERATURE REDUCTION

export trade has been encouraged by economic conditions. It has placed its chief reliance upon indigenous vegetable and animal raw materials; minerals have been exploited as far as possible, chief among them being coal, peat, salt and petroleum. Gelderland province is the source of most of the salt utilized, as it is also of "Drent" peat, which is utilized in the active carbon industry. The oil refineries at Pernis are the nucleus of an organic chemical industry of the newer type. Imported pyrites, phosphate rock and iron and zinc ores are to be found among non-indigenous raw materials.

Before the recent war, the Dutch chemical industries employed some 30,000 workers, and this number had increased at the beginning of 1947 to some 38,000. Pharmaceutical and allied manufacturing concerns total about 2,260, of which 62 percent are engaged in proprietaries of various types and 33 percent are wholesale houses.

Robert S. Aries, R. S. Aries & Associates, before Association of Consulting Chemists and Chemical Engineers, New York, Oct. 26, 1948.

FERTILIZER

Direct Application of Rock Phosphate

Thomas R. Cox

SIGNIFICANT gains in soil conservation are being made as a result of the rapidly increasing use of finely ground rock phosphate for direct application as fertilizer.

It will supplement, rather than replace, the more expensive chemically treated superphosphate. Consequently, the net effect of the new trend will be to increase the total amount of phosphorus restored to the land through fertilization.

In the past few years, direct use of rock phosphate has become so widespread that it is estimated that one-eighth of the entire current output of rock phosphate for fertilizer is being employed in this manner.

In 1946, a total of 528,097 tons was marketed for this purpose, representing an increase of 400 percent over 1940 and also 10 percent of the total 1946 production of rock phosphate for fertilizer.

Finely ground rock phosphate is not generally recommended unless legumes and sod crops occupy the soil a good part of the time. Agricultural experiment stations generally suggest that it be used in soil-conserving and soil building rotations, which include such legumes as alfalfa, sweet clover, and red clover. Other legumes which have shown good response to rock

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3. Bronze wearing rings easily and economically replaceable for long pump life.

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5. Plastic water seal gives positive control, and requires a minimum of attention.

QUICK INSTALLATION — It's a complete, low-cost pumping "package" — ready to hook up and put into service for a wide range of applications. Can be mounted in any position — fits into close quarters. Made to handle most liquids, with capacities from 15 to 1400 gpm, heads to 500 ft.

HIGH EFFICIENCY — Pump and motor are engineered and built together as a smooth-working team, and Allis-Chalmers takes undivided responsibility for performance. Every Electrifugal pump is run and tested at the factory for efficiency, capacity and head.

IMMEDIATE DELIVERY — Many sizes of Electrifugal, PEDRIFUGAL and SS UNIT pumps are now in stock at convenient points. Phone or wire your nearest Allis-Chalmers office or dealer for latest information on stocks and deliveries. For description of the complete line of A-C centrifugal pumps, to 600,000 gpm, ask for Bulletin B6059D.

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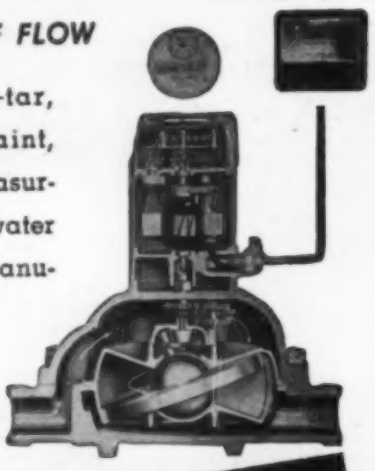

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COMPACT — 12" diameter x 22" high, requires 60% less storage space than ordinary carboy.

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Now available to all producers and distributors of liquid chemicals—a brand-new, thoroughly practical idea for the packaging of corrosive or expensive fluids. Far superior to all other types of containers now used for the same purpose, these new stainless steel drums have already been successfully applied to the packaging of nitric acid. They offer unusual economy in the reduction of labor handling costs and of freight charges, in the elimination of breakage and the conservation of valuable floor space. Write, call or wire for further details.

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phosphate are ladino clover, soybeans, and the lespedezas.

The preferred method of application is to mix well with the soil at or near seeding of the legume crops. Loss through erosion is reduced to a minimum by the latter procedure and the material is placed in the immediate root zone for optimum utilization.

A shortage of superphosphate in the Midwest during the war probably resulted in considerable use of rock as an outright substitute for superphosphate. Agricultural conservation programs in a large number of states have given rock phosphate a boost through the benefit payments made to farmers who use it. Quite important is the rapid development of equipment for bulk handling of rock.

Thomas R. Cox and M. V. Bailey, American Cyanamid Co., before Division of Fertilizer Chemistry, American Chemical Society, Aug. 31, 1948.

INSTRUMENTATION

Small Industry, Large Role

E. G. Bailey

THE INDUSTRIAL instrument industry plays a large role, far out of proportion to the investment involved, in American industrial production. A relatively small investment in instruments and regulators is guiding the generation of several billion dollars' worth of power each year. Many billion dollars' worth of chemicals, rubber, petroleum, iron, steel and other products are being aided with respect to quality and output through the use of instruments.

Gross annual sales in this field amount to probably less than $250,000,000. They are typically American companies, most of which started on a shoestring, where in someone invented a temperature recorder, a flow meter or some such useful device, which when perfected and sold to other industries aided them in saving fuel, producing better chemical product, saving labor, and protecting life and property.

Some of these instruments only guide an operator responsible for an industrial process so that he maintains conditions satisfactory for high quality and maximum output of a product. Many of the instruments are connected to automatic equipment, thereby completely controlling a process and assuring maximum economy in production, with only general supervision by man.

The instrument industry is in a peculiarly strategic position to really know a great deal about many other

PELLETIZER partly assembled in a Vulcan shop. Pulverized material is fed continuously through opening in stationary head and forms into spherical pellets at room temperature through action of paddles and contact with inner surface of revolving shell. Complete installation includes water spray for conditioning material. Welded steel shell has rolled-steel tires which ride on cast-steel rollers equipped with anti-friction bearings. Gear-ring pinion and paddle shaft are both driven by the same 20 hp. gearmotor.

Front view of pelletizer showing revolving shaft with ni-hard scraping paddles which keep material moving through shell at uniform rate and prevent formation of larger pellets than desired. Paddle shaft is mounted on anti-friction bearings. Fabricated-steel base is thoroughly reinforced, electrically welded, and machined on planer to assure accurate alignment of all parts and dust-tight seal between revolving shell and stationary head.

Vulcan Processing Equipment is backed by a
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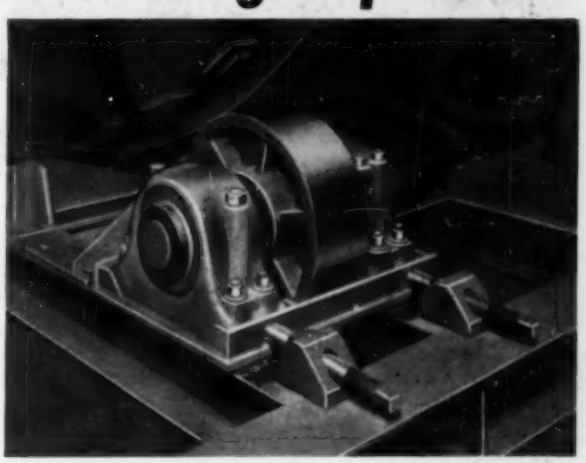
Established in 1849 the Vulcan Iron Works has grown steadily larger and stronger during its first hundred years of dependable service to users of heavy industrial machinery. Any machine or any part of a machine, built by Vulcan during that long period of time can be duplicated on demand—usually with very little delay.

For more than half a century we have been furnishing a constantly increasing variety of Rotary Kilns, Coolers, Dryers, Retorts, Roasters, Nodulizers, etc., to the chemical processing, rock products and metallurgical industries. In practically all cases these various types of rotary cylinders are designed and built especially to meet the purchaser's requirements and the "Pelletizer" here illustrated and described is an example of the excellent results secured through cooperation between Vulcan engineers and the purchaser's engineers or production executives.

Write us regarding any processing requirement to which a rotary cylinder of any size or type might be applied. Our engineers welcome opportunities to make helpful suggestions, whenever possible, without charge or obligation.



Close-up of supporting roller with anti-friction bearings. Entire assembly is mounted on a welded-steel sub-base which assures perfect alignment of shaft and bearings at all times and simplifies action of adjusting screws.

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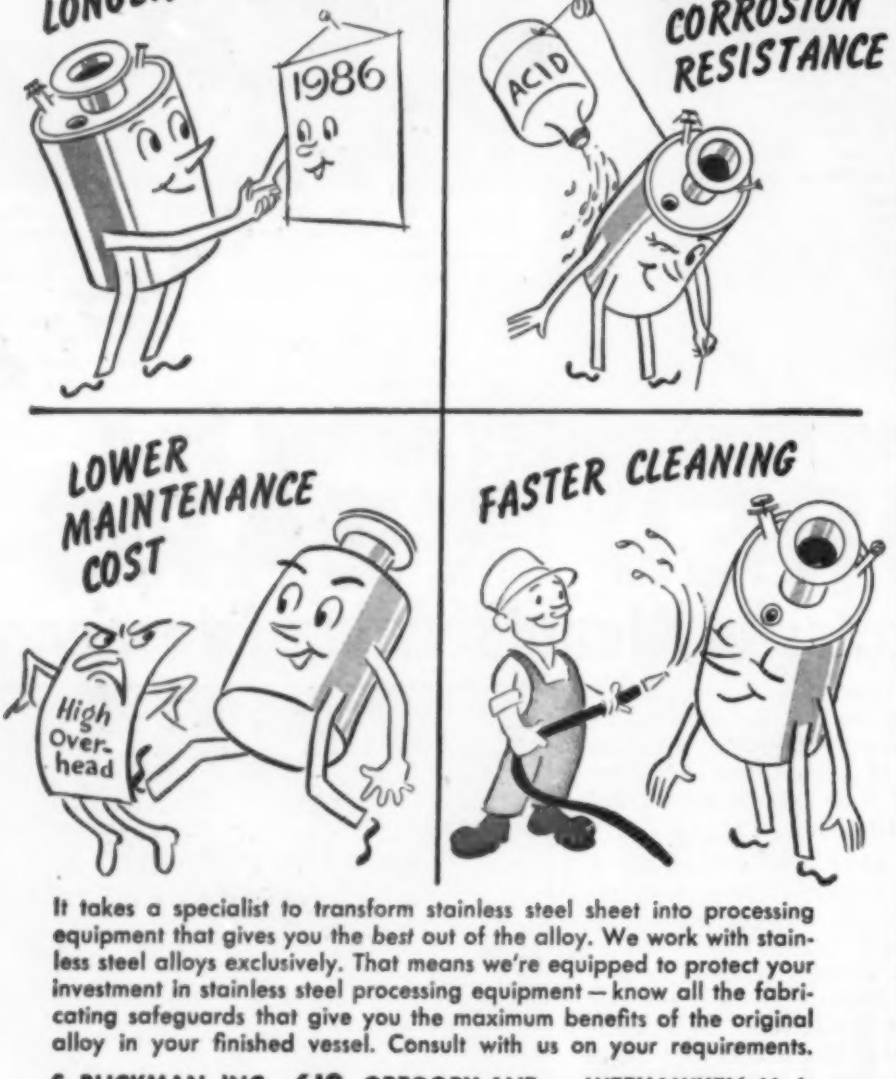

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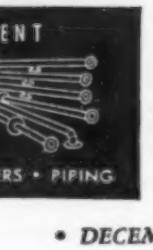

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industries because its equipment is applied at the very heart of their production. Instruments and regulators are not just sold off the shelf and installed by the customer; their application to a process is worked out between our engineers and those of the customer, practically tailor-made. When placed in operation the equipment is serviced to the degree necessary to obtain the desired results, in which industry's top executive management is keenly interested.

E. G. Bailey, president, American Society of Mechanical Engineers, before the Society, Philadelphia, Sept. 14, 1948.

RUBBER

Elastic Properties

Hubert M. James

RUBBER is prepared from liquid polyisoprene ("milled rubber") by vulcanization, a process which introduces a relatively few chemical bonds between the polyisoprene molecules. These bonds unite the long flexible molecules into a flexible but coherent network without otherwise modifying much the liquid-like structure of the material; this is why rubber is easily deformed, without being easily pulled apart.

The useful properties of rubber do not depend on its special composition, but only on its being a strong and flexible network of molecular chains with a freezing point below ordinary temperatures. Knowing this, the rubber chemist knows in a general way how to proceed in producing a new synthetic rubber. He must start with, or arrange for the production of, long flexible molecules. He must choose molecules which do not exert large forces on each other; otherwise he will get a glassy or hard plastic. He must make sure that the molecular chains are not too easily packed together into crystals; otherwise he will get a rigid crystalline solid. And, finally, he must arrange for the linking together of these molecules at enough, but not too many, points; otherwise he will get a viscous liquid or a brittle substance like the "hard rubber" of telephone mouthpieces.

The elastic properties of rubberlike materials are much like those of gases, both in character and in origin. The pull of a piece of stretched rubber is due to the jerking of the molecular chains in it; these, like the molecules of a gas, are in constant motion. An increase in the temperature increases the violence of this jerking, and thus the tension in the rubber. The variation of this tension with stretch and temperature can be predicted theoret-

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The simplest, surest mechanism ever devised for holding wheels to shafts. Another Dodge "first" —and the biggest development in this field in years!

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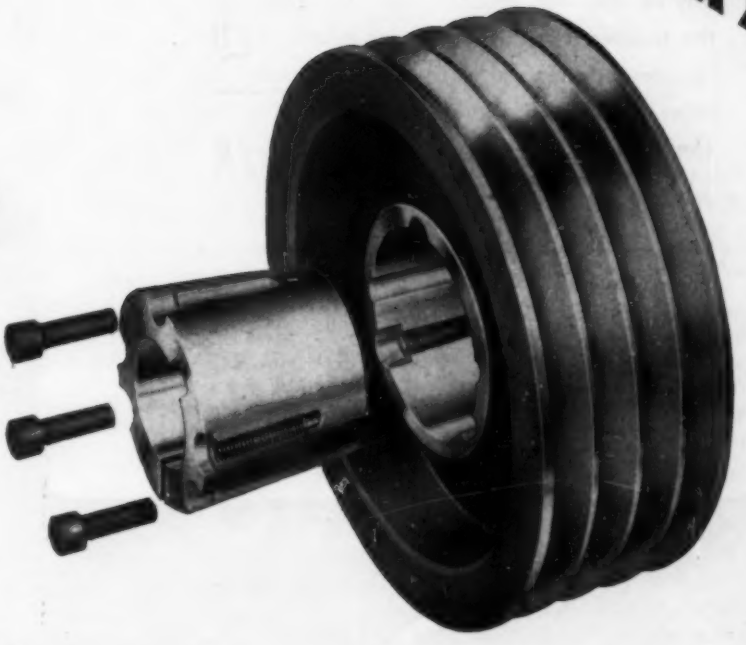

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★ Perhaps your problem involves an overhead traveling crane, rather than a hoist. If a crane will do a better job for you, that's what Shepard Niles engineers will recommend.

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ically for rubbers of especially simple ("ideal") structure, and follows a simple law. Soft rubbers in general deviate little from this ideal behavior when they are not stretched too violently. Large deviations occur, however, when the rubber is frozen by violent stretching.

Hubert M. James, Purdue University, before American Association for the Advancement of Science, Washington, Sept. 14, 1948.

PETROLEUM

Petroleum Test

J. H. D. Hooper

As PART of a program concerned with the solvent refining of lubricating oils, a method has been developed for determining the dissolved-gas and oxygen contents of oil samples. This method has been applied particularly to lubricating-oil components and also to furfural, but it can be used for determining dissolved oxygen in the majority of liquid-petroleum products, including volatile liquids such as gasoline.

The procedure, which is suitable for routine use, involves the removal of dissolved gas from a known weight of oil sample by agitation under reduced pressure in a special degassing vessel. Oils are normally degassed at 100 deg. C.; but for liquids with relatively low boiling points, such as furfural, the determination is made at room temperature. The extracted gas is measured in a burette and then transferred to a Haldane apparatus for the determination of oxygen content.

The test requires between 50 ml. and 150 ml. of sample; and a complete determination can be carried out in from 2 to 4 hr., depending upon the viscosity of the sample.

Accuracy of the method has been checked by using the apparatus to determine the solubility of oxygen in distilled water, when consistent results in close agreement with the known values were obtained.

J. H. D. Hooper, Anglo-Iranian Oil Co., before American Petroleum Institute, Chicago, Nov. 8, 1948.

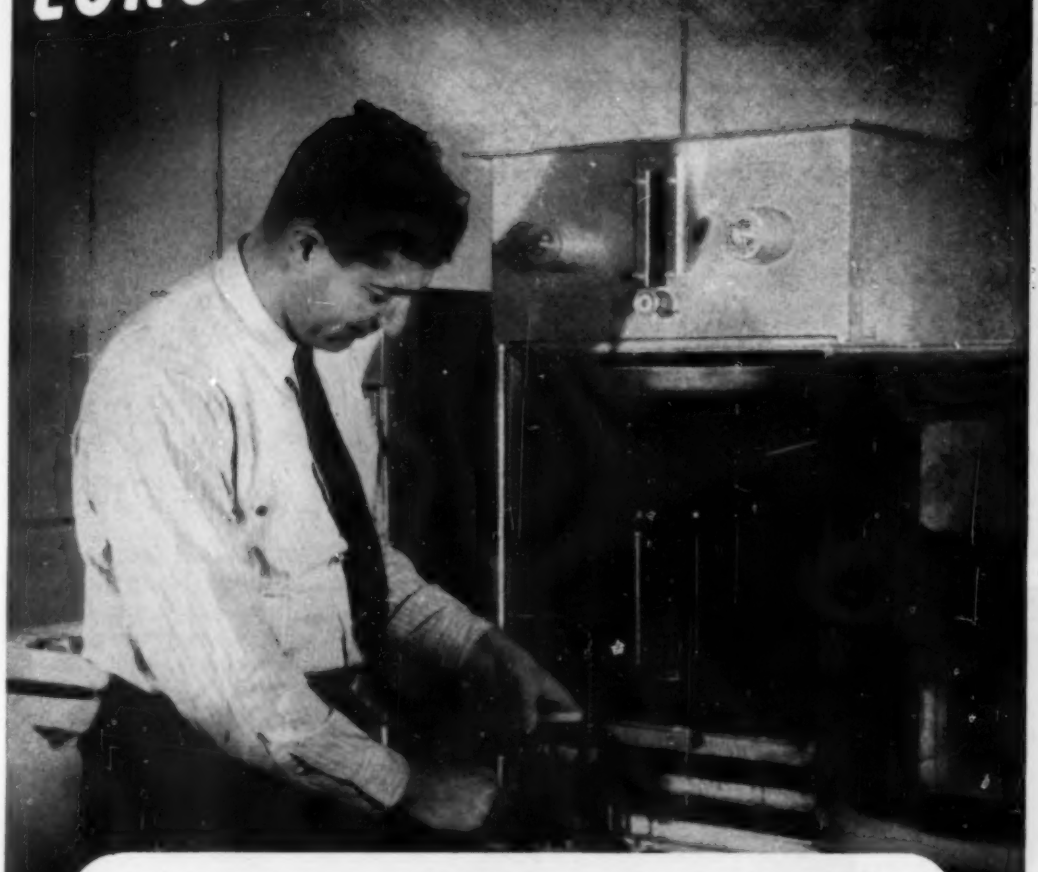
KINETICS

Reactor Design

Ralph R. Wenner

DESIGN of an efficient plant converter system depends primarily on finding the answers to the following questions which the process designer must have in advance of final design work: (1) What size reactor is required to meet a specified production rate? (2) What means are to be pro-

OVEN TEST COOKS UP LONGER LASTING PRODUCTS



QUAKER PRE-TESTED PRODUCTS FOR THE CHEMICAL INDUSTRY ARE PERFORMANCE-PROVED THROUGHOUT THE NATION

It may be called the "Oven Test," but to the buyer of Quaker Rubber Products it means producing rubber with the ability to withstand heavy static loads.

In making Quaker Rubber Hose it results in compounds of controlled specifications that will hold couplings over long periods of time . . . prevent hose from relaxing and allowing couplings to loosen. In packings, this pre-testing assures finished products that will hold their shape, will not relax, readily withstand pressures without the danger of blowouts.

This is only one of eighteen rigid tests that raw materials and finished products *must* pass before receiving the Quaker stamp of approval. Pre-testing provides quality and long service . . . assures worthwhile dividends for you through higher plant efficiency, lower operating costs. Call in your nearest Quaker distributor for hose, belting and packings.

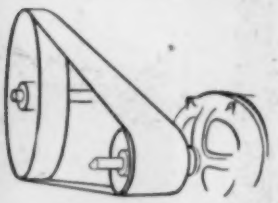
QUAKER RUBBER CORPORATION

PHILADELPHIA 24, PA. • New York 7 • Cleveland 15 • Chicago 16 • Houston 1
Western Territory
QUAKER PACIFIC RUBBER CO. • San Francisco 10 • Los Angeles 21 • Seattle 4

QUAKER RUBBER CORPORATION • PHILADELPHIA, PA. • QUALITY SINCE 1885

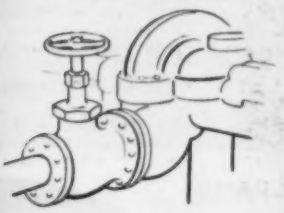
REG. U. S. PAT. OFF.

WHAT QUAKER Pre-Tested Products mean to the Chemical Industry



STEADY GRIP . . . LESS SLIP

Quaker V-belts and flat belting are pre-tested to provide plenty of grip, plenty of pull for more power. Pre-tested rubber stays flexible, withstands aging and abrasion.



TIGHT-SEALING OPERATION

Quaker pre-tested packings for all purposes keep pressure in . . . stop leaks on valve stems, piston rods, flanges. Made of pre-tested materials for long life.

LONG SERVICE AT HIGH PRESSURE

Quaker hose provides low-cost handling of steam, air, liquids, volatiles. Pre-tested rubber remains pliable, flexes easily, combats breakdown.

•

ENGINEERING SERVICE

When belting, hose, and packing problems bog down efficiency in your plant, call your Quaker Distributor for a quick solution.

QUAKER RUBBER PRODUCTS

custom made for every industrial use

THEISEN

Stainless Steel Products

STORAGE OR BATCH TANKS
10 to 100 gals.

PAILS
10 qt.
12 qt.
14 qt.
16 qt.
20 qt.
24 qt.

SAFETY PAILS

SAFETY CANS

In 3
& 5
Gals.

Dippers, Measures,
Scoops, Beakers,
Etc.

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Established 1923
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vided for supplying or removing the heat of reaction? This problem largely determines the type of reactor to be employed. (3) How can the converter system be controlled? (4) What are the most economical materials of construction available for fabricating the reactor?

The last two items are usually assigned to specialists in the fields of instrumentation and materials of construction.

It appears that a realistic understanding of what happens in any given reactor depends on the chemical engineer's ability to predict chemical and thermal phenomena from point to point as the reactants flow through the converter. This is a large order and thus far has been realized on only a few relatively simple systems. In order to do this, it is necessary to obtain kinetic equations relating the instantaneous rates of reaction to the concentrations, pressures, and temperatures existing at any given distance from the converter entrance. Once having obtained these kinetic equations, secondary equations for the rate of heat generation or absorption can be evolved from the known thermochemical properties of the system and the heat transfer and fluid flow correlations available in the literature.

Such a set of equations may then, in principle, be used to compute the size of a reactor required to meet a definite production rate under a variety of operating conditions. Thus it can be seen that a fundamental kinetic analysis based on bench or pilot plant experimental investigations is required for the design of the reactor system as well as its efficient operation under conditions of variable production demand or accidental upsets in plant routine.

Ralph R. Wenner, Monsanto Chemical Co., before the American Society for Engineering Education, Madison, Wis.

FOREIGN LITERATURE ABSTRACTS

Carbon Monoxide Chemistry

CARBON MONOXIDE is one of those simple chemical compounds which is on the border of inorganic and organic compounds and is therefore of equal interest to both inorganic and organic chemists. A study was made of the reactions of carbon monoxide with metallic potassium, alkalis and the hydrolyzable salts of strong bases, with ammonia and amines, alcoholates of alkali metals, alcohols, phenolates, olefins and ketones in the presence of

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On every liquid mixing job
For over 25 years, processing men have relied on the consistent high standard of Alsop "Hy-Speed" Mixers and Agitators —and on the technical service of the Alsop Engineering Corporation to help solve their mixing problems.
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Perhaps we can help you solve your mixing problem; write giving details of liquids and quantities to be handled.
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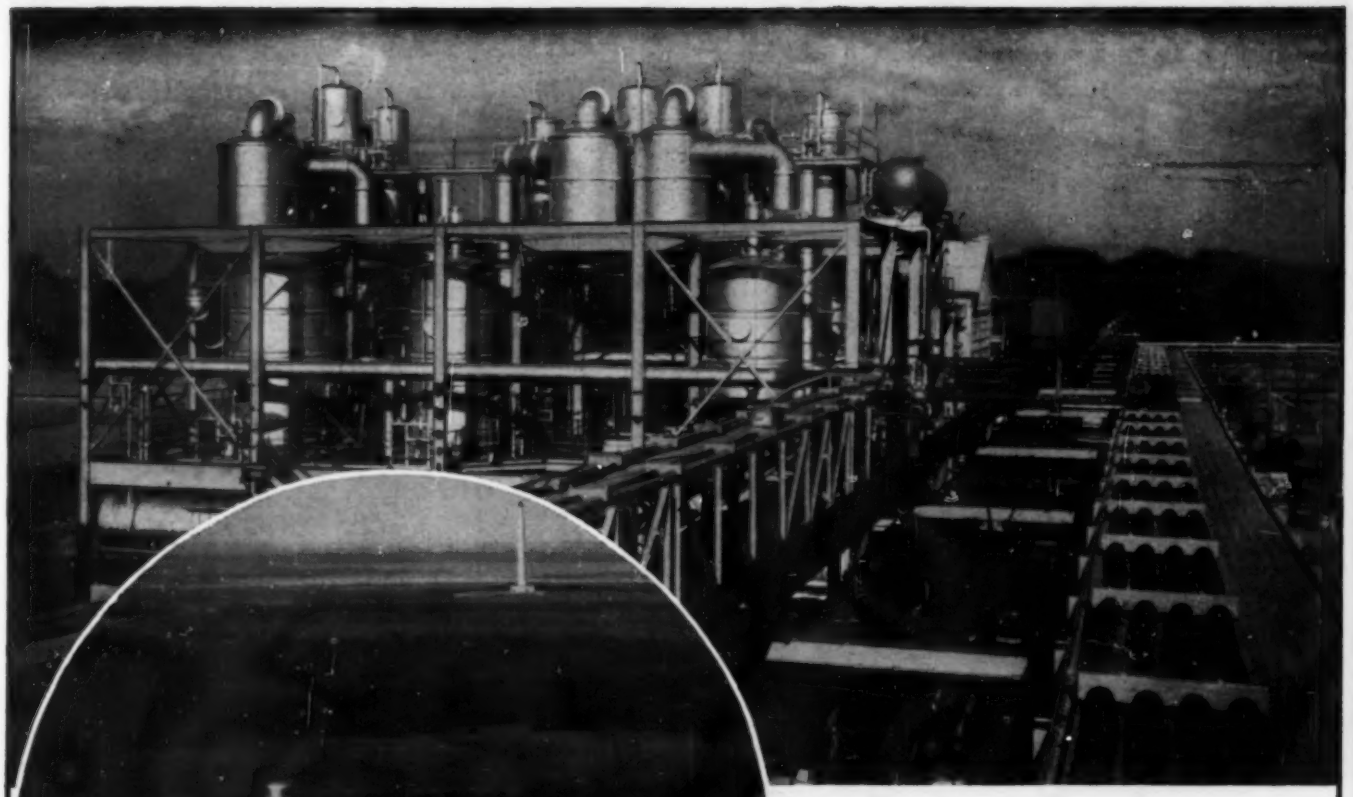

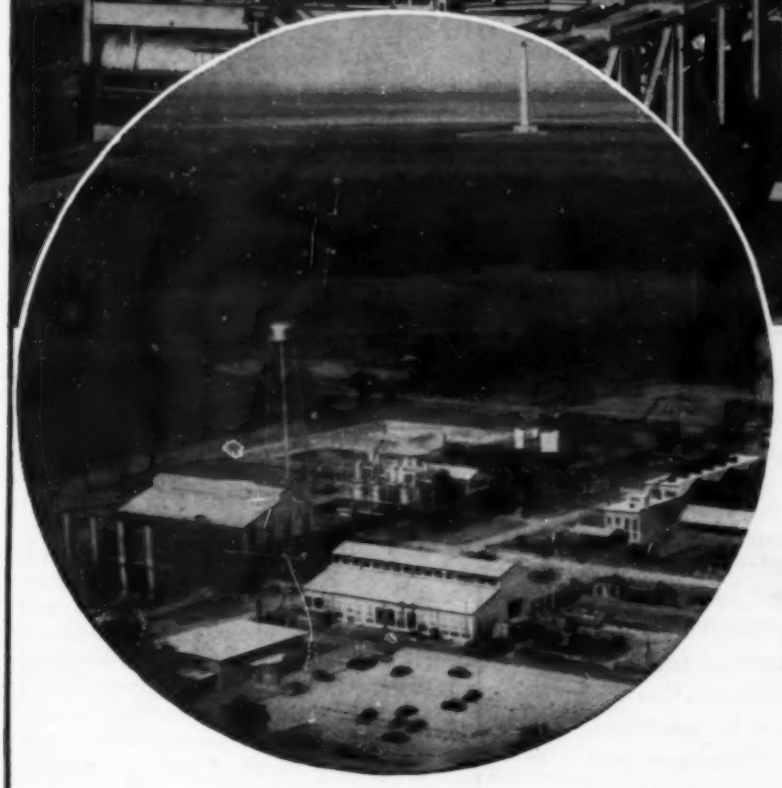

WE'RE PROUD OF DIAMOND'S NEWEST CHEMICAL WORKS

Diamond Alkali Company's newest chemical plant, the Houston Works on the Houston Ship Channel, recently went on stream, manufacturing chlorine and caustic for what it's able young president, R. F. Evans, so aptly described as "the living, growing, expanding chemical industry." Brown & Root, Inc. are proud to have been selected for engineering and construction of this great plant—proud of the part we have in the process industry in the Southwest, which is fast securing its position as a world chemical capital.

BROWN & ROOT, Inc.

P. O. Box 2634 Houston 1, Texas

Above: 10,000-gallon fermentation vessel for use in the pharmaceutical industry. Fabricated from Type 316 stainless steel with 4" steam coil, ⅜" shell, ½" heads and 10' 6" diameter x 15' straight side.

Shaping things to come

In the pursuit of new products and processes, chemical research often finds itself facing a problem created by the need for special experimental and production vessels or equipment which, literally, do not exist.

★ ★ ★

Breaking through these barriers to progress—creating new equipment that exists only on blueprints or in the mind's eye—has been our specialty for more than a quarter-century.

In this time, we have brought together and trained a staff that is particularly well suited to the creation and fabrication of non-conventional equipment for pilot-scale or full production operations. Our plant is equipped with the most modern manufacturing, welding, machining and finishing facilities, so that all operations can be performed right here under our direct control.

As pioneers in the successful welding of corrosion-resistant metals, we have served many of the nation's foremost chemical, pharmaceutical and processing industries. This long experience, we believe, will enable us to handle the most unusual assignments, or any part of them, efficiently and to your complete satisfaction. Just write, wire or phone. We'll be glad to discuss your problems without obligation.

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water vapor. Not all the reactions were investigated experimentally to an equal degree and not all of them are of equal practical importance at present. Some of them (for example, the reaction of carbon monoxide with bases and ammonia) are already of considerable practical interest as methods for the preparation of formates, hydrocyanic acid, cyanides. Some require certain additional work to become industrial processes, for example —preparation of formic acid and acetic acid and their esters. At the same time these reactions, in addition to the processes for the preparation of methanol, higher alcohols, gasoline and solid paraffins, indicate the great possibilities of carbon monoxide for organic synthesis, as well as the important role which catalytic methods and high pressure will play now and in the future.

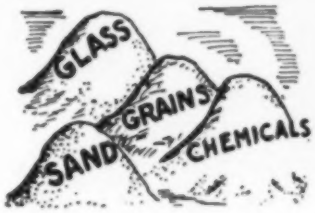
Digest from "Some Reactions of Carbon Monoxide with Acid and Basic Agents" by J. T. Eudus, *Uspekhi Khimii* XVI, No. 5, 599-626, 1947. (Published in Russia.)

Brazil's Sulphuric Acid Industry

BRAZIL's 12 existing sulphuric acid plants produced about 74,460 metric tons in 1946 (basis 100 percent H_2SO_4), with capacity estimated at 83,585 tons. Production from contact plants is estimated to be 42,340 tons. Production figures, excluding the Piquete plant, for 1938-43 in tons were: 1938-21,676; 1939-26,663; 1940-28,898; 1941-33,956; 1942-35,920; 1943-36,699. All of this output came from five plants near Sao Paulo, and represented practically the entire country's commercial production in those years. Of the 12 plants operating in 1946, 10 were in the Sao Paulo area. Two of the latter were contact units which sold a part of their production and consumed part themselves (making aluminum sulphate). The eight other Sao Paulo plants were chamber units. One specialized in a special denitrated-grade acid; one used its entire output for production of superphosphate; and one plant used its output for the manufacture of aluminum sulphate. At least one plant utilized sulphur dioxide from the waste gases of a zinc plant as a source of sulphur, and one plant sold its entire output of acid. One of the plants operating in 1946 was located in the State of Rio de Janeiro. It was part of a government explosives plant, and was a contact unit. The remaining plant was at Barigui, State of Parana, and was a chamber unit using local pyrite and sulphur. Part of the output was sold and part used in the plant where produced. Four additional contact plants were contemplated or under construction in 1946. One was to be located in the Sao Paulo area primarily to supply a large rayon factory. One was to

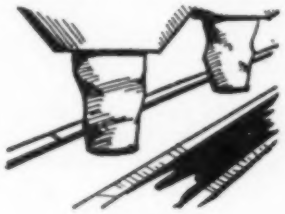
Questions and Answers about AJAX LO-VEYORS

WHAT MATERIALS CAN BE HANDLED?



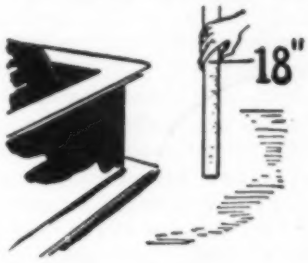
Dry aggregate materials ranging from granular up to 6" lumps such as sand, cereals, chemicals and many others.

IS DUST-TIGHT OPERATION AVAILABLE?



Flat conveyor pans with cover and booted inlets and outlets and also gastight tubular conveyors permit handling materials without contamination or explosion

HOW MUCH HEAD ROOM IS REQUIRED?



Average overall height is less than 18" except for a short distance where shaker is mounted.

HOW DO AJAX LO-VEYORS REDUCE COSTS?

They eliminate moving materials by costly nonproductive shovel and wheelbarrow methods.

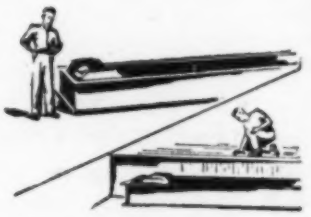
ARE ABRASIVE CONDITIONS HARMFUL?

Unaffected by sand and abrasives, they are ideal for foundries, chemical plants, cement mills, etc.

HOW DOES AJAX REDUCE WEAR?

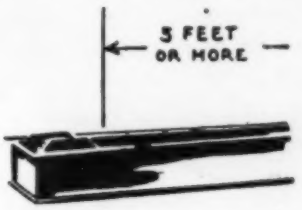
Reciprocating drive unit is completely enclosed. All eccentrics, idler pulleys and exposed bearings are eliminated.

CAN AJAX LO-VEYORS BE INSTALLED ANYWHERE?



They are self-contained units ready to set in place and use. Easily installed on or below floor or suspended from wall or ceiling.

CAN THEY BE USED FOR SHORT AND LONG CARRIES?



Lengths, widths and capacities to suit various materials, plant conditions and requirements of the process.

ARE AJAX LO-VEYORS ECONOMICAL?

They are economical to buy, operate and maintain.

•

Write telling us your material handling needs and Ajax engineers will make recommendations.

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For Real Protection...Real Value

The Goodall line of quality workwear meets every requirement for plant or laboratory with the greatest possible protection, comfort and economy.

COATS, APRONS, OVERALLS . . .

Acid, oil and chemical resisting, in styles to meet all needs. Carefully tailored in every detail to assure good appearance, comfortable fit and long wear.

LOW ACID SHOES . . .

Made with slip-proof tire-tread soles and "Toe-Saver" safety toe caps. Light weight, comfortable.

DURABLE BLACK BOOTS . . .

Short, black boots of high quality rubber, treated to resist the action of oil. All-Neoprene sole and heel.

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Smooth, flexible and effective against puncturing and snagging. The safest, easiest wearing gloves you can buy.

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RECEIVER BOX

Schutz O'Neill PULVERIZER

The Schutz-O'Neill Pulverizer with Receiver Box is a versatile unit, for rapid processing of any dry, grindable, non-gritty stock to desired fineness. Easy to clean or change for different materials. Accurate grinding control, with sharp separation and uniform fineness. Air force pulverizing plus air separation is the proven, automatic, dustless method.

Sizes from 12" up to 28", with capacities up to 2,000 lbs. per hour. Ask our engineers to analyze your requirements. No obligation.

Also makers of Schutz-O'Neill Gyrator Sifters, Roller Mills, Hammer Mills, Etc.

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be located in Recife, State of Pernambuco, to provide acid for superphosphate manufacture. A third was to be established in Rio Grande do Sul to supply a petroleum company with its acid requirements for refining, and the fourth was to be located at Barra Mansa in connection with a commercial explosives plant.

The end uses of sulphuric acid in Brazil in 1946, in the approximate order of their importance, were: rayon manufacture; nitric and hydrochloric acid manufacture; textile industry; manufacture of aluminum sulphate, explosives, fertilizer; metallurgy; sugar refining; and preparation of other chemicals. Imports of sulphuric acid have been of little importance since Brazil is quite self-sufficient with respect to this commodity.

Digest from "Brazil's Sulfuric Acid Industry," *Brazil Trade Journal*, III, No. 3-4, p. 8, 1947. (Published in Brazil.)

Polish Chemical Industry

ALMOST 12 percent of the total number of chemical works existing in Poland today are owned by the state. By the end of 1946, 187 factories were under the control of the "Centralny Zarzad Prezemyslu Chemicznego," which can be broken down as follows according to their products: chemical fertilizer—15 plants; inorganic chemicals—16; tar products—20; explosives—8; industrial gases—23; medicinals and organic chemicals—25; rubber articles and synthetic materials—20; industrial fats—25; paints and varnishes—17; chemico-technical products—16; offices for investments and reconstruction—2. The total number of workers in the Polish chemical industry was 45,000 by the end of 1947, 39,000 by the end of 1946 and 49,000 by the end of 1938. The attached table gives production figures, in tons, for some of Poland's important chemical products.

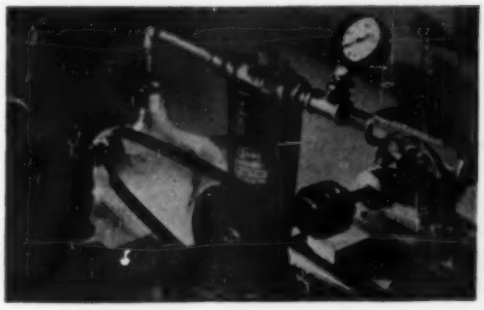
Poland's Chemical Products, Tons

	1946	1947
Sulphuric acid	31,968	47,662
Hydrochloric acid	3,031	3,840
Calcined soda	116,267	141,244
Caustic soda	15,365	30,601
Bleaching powder	1,558	3,540
Glauber's salt	5,423	7,627
Potassium and sodium bichromates	151	477
Oxygen (1,000 cu.m.)	4,529	6,320
Acetylene (1,000 cu.m.)	1,074	1,276
Ammonium nitrate	6,129	8,477
Nitrogenous fertilizer	37,061	67,400
Superphosphate	159,050	182,976
Ultramarine	149	515
Zinc oxide	4,750	7,739
White lead	.....	1,300
Varnishes	1,191	2,690
Dyestuffs	1,569	2,082
Tar	37,284	53,590
Carbon electrodes	4,688	5,360
Soap	4,255	7,054
Glycerine	53	117
Rubber tires	511	1,406
Rubber tubes	62	217

Digest from "Polish Chemical Industry" by S. Balke, *Angewandte Chemie* B 20, No. 7, 185-188, 1948. (Published in Germany.)

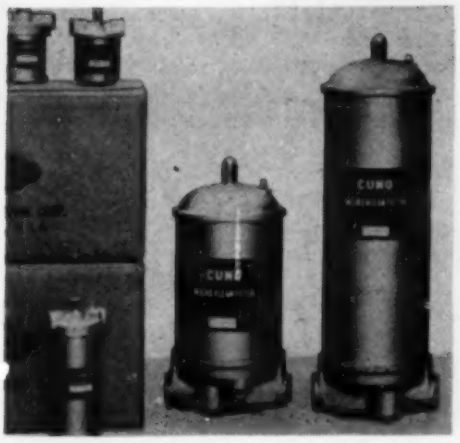
Keeps Hot Water out of Hot Water

To prevent contamination by rust and scale of hot process water used in the manufacture of stearates, M. W. Parsons, Imports & Plymouth Laboratories Inc., Brooklyn, use a Cuno MICRO-KLEAN Filter which positively removes the unwanted solids.



Handles wide range of fluids

In another application at Teaneck Chemical Co., Cuno MICRO-KLEAN with 25-micron cartridge handles 1-2 gpm of very viscous photographic chemical solution at 65 psi.

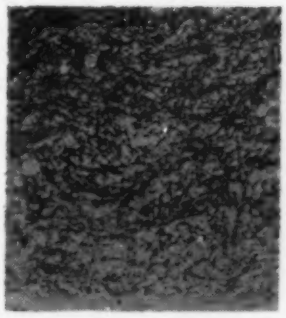


Cartridges...Filters...for all jobs

Cuno MICRO-KLEAN filters come in densities of 25 and 10 microns . . . capacities from a few to 850 gpm . . . connections from $\frac{3}{8}$ in. IPS to 6 in. flanged . . . single or multiple cartridges to handle full flow. MICRO-KLEAN cartridges fit other makes; special lengths available for built-in installations.

Cuts cartridge replacement in half

Exclusive fibre construction of Cuno MICRO-KLEAN permits smaller particles to penetrate to varying depths. No surface-loading—graded-density-in-depth increases dirt capacity—doubles cartridge life. Resinous impregnation and polymerization bonds each fibre in position to prevent channeling, rupturing, shrinking and distortion.



Making the broadest line of fluid filters, Cuno is your best source for unbiased recommendations on any fluid filtration problem.

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Please send information on Cuno MICRO-KLEAN for services checked.

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- ☐ Water and Water Solutions
- ☐ Compressed Air
- ☐ Fuel Oil
- ☐ Acids
- ☐ Any other.....
- ☐ Send free cartridge for installation in { ..... (filter make)

Name.....Title.....

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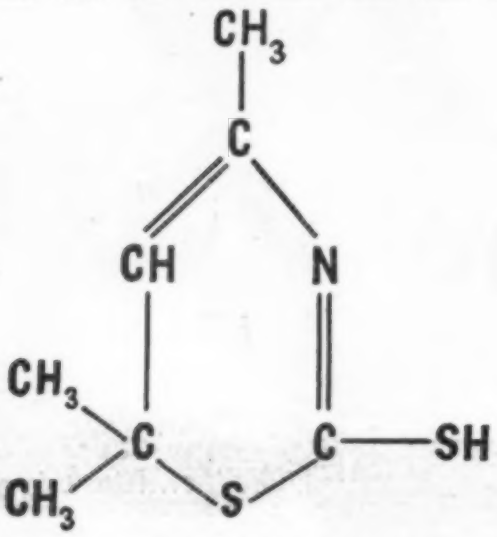
Micronic . . . Disc-Type . . . Wire-Wound . . . Fabric Filter

3 Chemicals

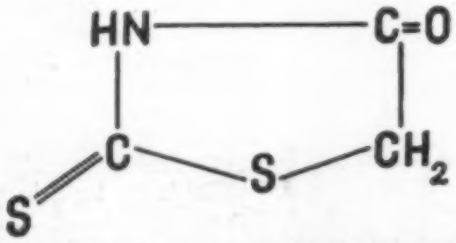
THAT MAY OPEN UP NEW FIELDS



Good-rite M.T.M.T.

2-Mercapto-4,6,6-Trimethyl Thiazine

As an intermediate, M.T.M.T. is expected to find many applications in the manufacture of wetting agents, pharmaceuticals, and other specialty chemicals not heretofore possible. As a new composition of matter, its chemical structure will suggest utility in a wide variety of fields.



Good-rite RHODANINE

2-Thio-4-Keto-Thiazolidine

This material is soluble in alcohol, ether, alkali, and hot water. Rhodanine reacts readily with aromatic aldehydes and the resulting derivatives are useful as intermediates for the manufacture of arylamino acids, arylthio-pyruvic acids, arylacetonitriles, and arylethyl amines, all with unusually high yields.

$NH_2\text{-}CH_2\text{-}CH_2\text{-}OSO_3H$

Good-rite A.E.S.A.

2-Aminoethyl Sulfuric Acid

Source of Ethylene Imine. Suggested for use in the paper industry to increase wet strength and water repellency. Recent laboratory work indicates interesting results in the treatment of cotton fibres. Since aminoethyl sulfuric acid reacts with most compounds containing an active hydrogen atom, the material is widely applicable as an aminoethylating agent.

For detailed technical bulletins on these chemicals please write Department CD-12, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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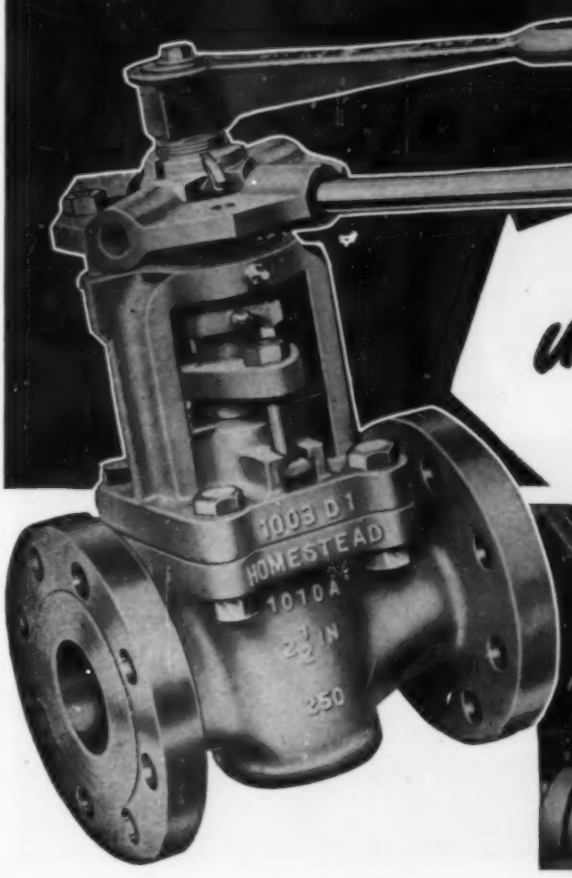
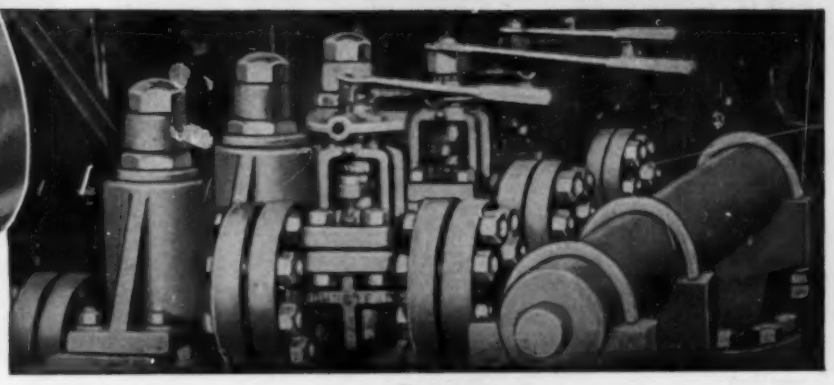
in Services Involving Extreme Temperatures, Pressures and Corrosive Fluids

use HOMESTEAD LEVER-SEALD VALVES





For more than 15 years HOMESTEAD LEVER-SEALD VALVES have solved the operating difficulties of hundreds of manufacturers in services where temperature extremes, pressure and the corrosive action of line fluids would cause ordinary valves to stick or "seize."

HOMESTEAD LEVER-SEALD VALVES *never* stick. For built into each valve is a powerful lever and screw device which relieves seating pressure between plug and body just enough to overcome friction and permit *easy turning at all times and under all conditions.*

They operate *faster* too . . . 16 to 28 times faster than screw-stem-type valves, because a QUARTER-TURN *fully opens or closes* them. The QUARTER-TURN principle also makes them ideal for installation in restricted areas, next to walls, floors, ceilings, congested piping and other obstructions where many other types of valves could not be operated.

HOMESTEAD LEVER-SEALD VALVES are available in combinations of metals and alloys to meet *your* service requirements. Sizes range from 1½" to 10" for pressures from vacuum to 1500 pounds. For complete details write for Valve Reference Book No. 38. No obligation.

CHECK THESE OUTSTANDING FEATURES

- **A QUARTER-TURN fully opens or closes valve.**
- **INSTANT STICKPROOF OPERATION. Plug turns freely after seating pressure is relieved by screw lever.**
- **LEAK PROOF. Deep stuffing box and gland prevent leakage.**
- **POSITIVE LEAKLESS SEAL WITHOUT USE OF LUBRICANT is obtained by reapplying full seating pressure with screw lever after opening or closing.**
- **STRAIGHT-LINE FLUID FLOW. No obstructions to cause pressure drop.**
- **SEATING SURFACES ALWAYS PROTECTED in both open and closed positions. Fluid or grit cannot damage valve seat.**
- **SEALED BOTTOM prevents fluid loss and reduces hazards.**

HOMESTEAD VALVE MANUFACTURING CO.

P. O. BOX 13 CORAOPOLIS, PA.

Facts about J-M Insulations Subject: RESEARCH

They measure heat to save millions for industry

ACCURATE HEAT FLOW MEASUREMENTS are being made by this man to test the thermal conductivity of pipe insulation. He can make readings within ⅓ of 1 degree F. at 800 different points on this apparatus in the Johns-Manville Research Laboratory—the largest, best equipped and most modern thermal testing laboratory in the world.

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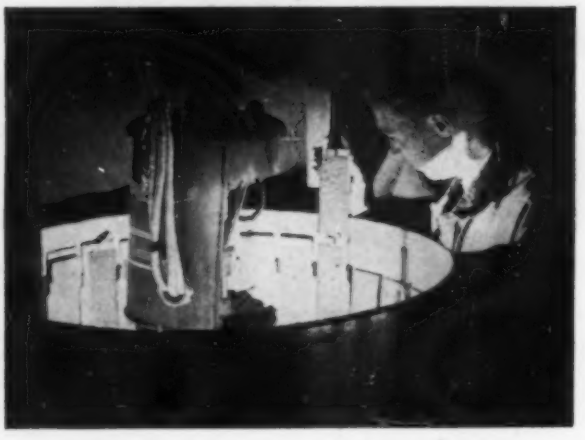

MAN-MADE WEATHER in this machine tests the ability of insulation jackets and casings to withstand exposure to sunshine, rain and freezing temperatures. The trend toward "outdoor" equipment in many industries makes the findings of this research invaluable.

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CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Must Science be Controlled?

OF FLIGHT AND LIFE. *By Charles A. Lindbergh. Charles Scribner's Sons, New York. 56 pages. $1.50.*

WHETHER you are an ardent admirer or bitter critic of Charles Lindbergh, it will be good for your soul to read "Of Flight and Life." This little book of less than sixty pages reflects some pretty bold thinking on an issue that is likely to become increasingly important. At a time when we are beginning to hear the old cant of the defeatists arguing for a moratorium on research, it is refreshing to read this sane analysis of what we too flippantly call the battle between social and physical sciences. This is a deeply religious study by one who is searching sincerely for a solution to a problem sometimes stated as the survival of civilization itself.

Like most of us, Lindbergh grew up in an age when science seemed more important than either man or God. Its problems—and promises—alone were clear and tangible. The potentialities of its benefits seemed unlimited. "In its learning seemed to lie all the mysteries of life." Wiser now, the author admits "It took many years for me to discover that science, with all its brilliance, lights only a middle chapter of creation—a chapter with both ends bordering on the infinite, one which can be forever expanded but never completed. When man devotes too much time to this chapter he loses the greatest value of the book." So it is that modern man must seek a better balance of the basic values in life—of body, mind and spirit. Our futures, perhaps even the survival of Western Civilization, are fully as "dependent on the quality of life as on the power of arms—dependent on a perpetual balance of spiritual and material forces."

In attacking scientific materialism, Lindbergh writes in a very persuasive preface that "science has become the victim of its technologists, just as religion became the victim of its fanatics. Just as the spiritual truths were perverted by the temporal exploitation of Christian creed and dogma, so the intellectual truths of science are being perverted by the material exploitation of industry and war."

But this is no shifting of blame from one part of our population to another. Our problems are mutual. The only solution lies in the balanced qualities of spirit, mind and body of our people. "Without this control, without this balance, our military victories can bring no lasting peace, our laws no lasting justice, our science no lasting progress." Again, I say, it will do your soul good to read this book.—*S. D. Kirkpatrick.*

Practice

SCIENTIFIC RUSSIAN READER. *By Noah G. Gershevsky. Pitman Publishing Corp., New York. 253 pages.*

PROFESSOR Gershevsky's reader is the first of its kind to be published in this country and will be a great help to the many students who are now studying scientific Russian in American universities. It contains 28 selections in chemistry and 98 in physics taken from Soviet scientific periodicals and abstracts, college and high-school texts and reference books. The original material was not edited, so that many involved and difficult sentence structures are included. Most of the readings are from half to approximately one page long and each is on a different subject. The selections are such that each reading contains a good number of typical terms and really provides the student with an active and varied vocabulary. Each reading is followed by notes translating the especially difficult passages and discussing grammatical and vocabulary difficulties, as well as by a vocabulary of the scientific terms used. The ordinary terms used are included in the vocabulary at the end of the text which contains close to 2,500 words. The definitions given are accurate and include sufficient, well-chosen synonyms for an intelligent understanding of the text. The translated passages are handled with skill and precision.

Although the Russians are not behaving in very friendly fashion just now, they are still doing very interesting work in chemistry, physics and the many other fields of science. American research men and students are as eager as ever to follow Soviet developments and there is every reason to believe that scientific Russian will become as important in our universities as German once was. According to the Soviet periodical *Uspekhi Khimii*, there are nine leading chemical journals published in Russia today, numerous periodicals dealing with the different branches of the chemical industry, and transactions and reports of a large number of research and educational chemical institutes. A few periodicals were suspended during the war and will be resumed when conditions permit. Altogether, it is a rich field for literature searches and is well worth the time and effort of chemistry and chemical engineering students.—*Ludmilla I. Callaham.*

Oil from Shale

OIL SHALES AND SHALE OILS. *By H. S. Bell. D. Van Nostrand Co., New York. 157 pages. $4.*

NOT SINCE 1925, when Ralph McKee published his "Shale Oil," has another book on the subject been published in this country. Few articles have appeared; chief of these have been the ones by Guthrie of the U.S. Bureau of Mines. The reasons are easy to understand—interest in the subject has been at a low ebb. This situation is changing rapidly, mainly because of the development work on oil shales and shale oils now under way by the Bureau of Mines, Union Oil of California and Standard Development Co.

The value of Bell's work lies mainly

RECENT BOOKS RECEIVED

Cobalt. By R. S. Young. Reinhold. $5.

Crystal Structures. By R. W. G. Wyckoff. Interscience. $8.

Die Chemische Industrie und Ihre Nebenprodukte. 4th ed. Available from Franz Feigl, New York. $5.

Fundamental Organic Chemistry. By E. F. Degering. University Lithoprinters. $4.50.

Inorganic Chemistry. 5th ed. F. Ephraim. Interscience. $8.75.

Organic Chemistry. Vol. IV. By R. Adams. Wiley. $6.

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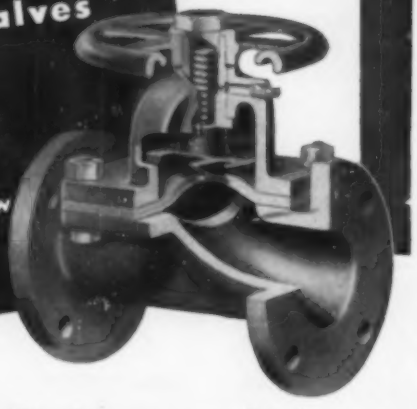

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in the fact that it brings together and summarizes the existing information on the methods and economics of producing oil from shale. Most data come from hard-to-find foreign sources, and it is a pleasure to know that some of it has been slipped through the narrowing cracks of the Iron Curtain.

Individual chapters deal with the geographical distribution of oil-bearing shales, characteristics of shale and shale oil, mining methods, preparation of rock, retorting, refining, and economics.—*JRC.*

1.9 Cents Per Page

THE PREPARATION, PROPERTIES, CHEMICAL BEHAVIOR AND IDENTIFICATION OF ORGANIC CHLORINE COMPOUNDS. *By Ernest Hamlin Huntress. John Wiley & Sons, New York. 1,443 pages. $27.50.*

"1,443 pages *is* a lot of book—but data on 1,320 organic chlorine compounds is a *lot* of chemistry." So reads the publisher's "blurb" for this book. To which may be added that $27.50, even in these days of inflation, may seem by some, to be a "lot of money" for one book. As a reference book, however, the cost per unit of data presented is very low, indeed, when one considers the tremendous volume of printed literature abstracted in the 22,000 references and indexed in five different kinds of indexes. There is presented, probably, just about everything on organic chlorine compounds which any organic chemist would need. For such a presentation of data there is used a specially devised index system depending on classifications, orders, sub-orders, divisions, abbreviations, symbols, etc. This system may seem cumbersome for those using the volume only occasionally, but allows the compression of the wealth of material between the boards of a single book. This product of a great amount of painstaking collection of knowledge will be a great timesaver for those specializing in the field and a useful reference book when available for those whose needs are more casual.—*Donald F. Othmer.*

Ethyne

ACETYLENE CHEMISTRY. *By Ernst David Bergmann. Interscience Publishers, Inc., New York. 108 pages. $3.*

THIS short monograph on acetylene chemistry is both timely and stimulating. It contains three lectures; the first discusses the more usual reactions of acetylenes, the second describes the condensation of acetylenes with aldehydes and ketones, and the third presents a survey of the polymerization

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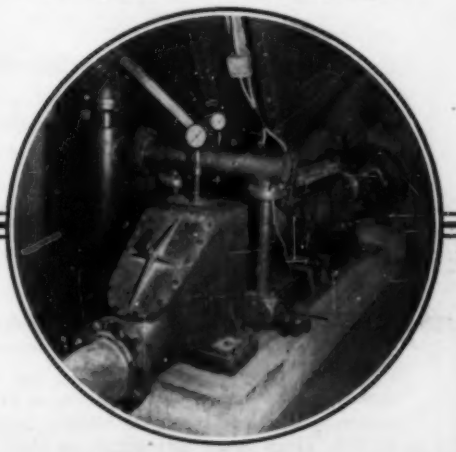

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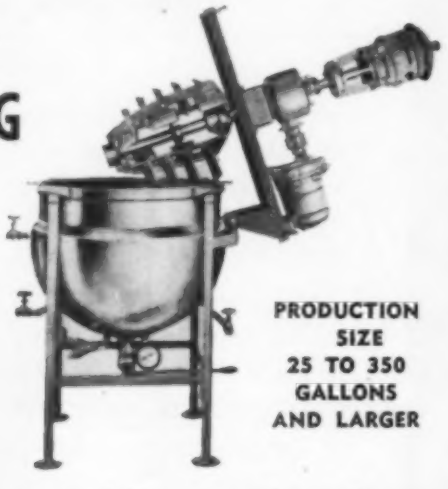

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reactions of these compounds including the synthesis and transformations of vinylacetylene and cyclooctatetraene. It is inevitable that so short a presentation must omit many interesting points, but the author has selected material which indicates the principal trends in acetylene chemistry. Attention is also focused on a number of little-understood reactions which invite study. The main emphasis is placed on the reactions of acetylene itself, but attention is also given to substituted acetylenes, especially when these are readily obtained from the parent compound. The recent advances made by Reppe and his coworkers are correlated with other work in the field in a satisfying manner. Professor Bergmann writes with an immediacy that bespeaks his long experience and interest in acetylene chemistry. One may disagree occasionally with his interpretation of some of the reactions, but this only adds to the pleasure of reading. While the book is not written from an industrial viewpoint, it presents ideas that merit thought by the industrial chemist. It can be recommended to all organic chemists as a short and interesting discussion of a field that is progressing rapidly.—*Thomas L. Jacobs.*

Rubber

MODERN RUBBER CHEMISTRY. *By Harry Barron. D. Van Nostrand Co., New York. 502 pages. $7.50.*

THIS book covers just about every phase of natural rubber and the natural rubber industry: history, chemical and physical properties, compounding and plasticizing, vulcanization, accelerators, reclaiming, latex, tires, equipment and machinery. Objectives of the author are primarily educational; yet this is one of the very few reference books in the English language available on the subject of natural rubber (the author has an earlier book devoted to synthetic rubbers). In general, the subject matter is covered well, especially insofar as British industrial practice is concerned, up to the period of about 1944-1945. Very recent developments in some segments of the industry naturally could not be included in this edition.—*JRC.*

Still the Same

INTRODUCTION TO CHEMICAL THERMODYNAMICS. *By Luke E. Steiner. McGraw-Hill Book Co., New York. 510 pages. $6.*

THIS reviewer has used the first edition of this text for five years and has reviewed the present edition from the standpoint of its improvement over the earlier work. There appear to be

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no other texts which cover the subject matter in the elementary manner treated in the second edition. But it is still the same weak text as the first edition, having failed to rectify its major defects. These are the lack of visual pedagogy, failure to solve adequate illustrative problems and poor exercises at the conclusions of the chapters. Much of the pure descriptive matter is still vague and in a number of instances the nomenclature has been poorly chosen. Certain important points such as entropy, free energy and the phase rule appear to be far removed from everyday reality. To this reviewer it seems that a student will still find the information gained from the text very difficult to apply. The problems at the ends of the chapters are of the academic type and fail to reinforce the practical aspects of thermodynamics.

Note: This review was prepared by an instructor who prefers to remain anonymous. He is qualified to appraise the Steiner book after five years of teaching thermodynamics in an AIChE-accredited school.—*Editor.*

RECENT BOOKS and PAMPHLETS

Prevention of Iron and Steel Corrosion. By C. Dinsdale. Published by Louis Cassier Co., Ltd., Dorset House, Stamford St., London, England. 67 pages. Contains three parts: Methods of Preventing Corrosion, Cleaning Metal Parts, Codes of Practice.

Phosphorus Oxychloride. Chemical Safety Data Sheet SD-26, published by Manufacturing Chemists' Association, 246 Woodward Bldg., Washington 5, D. C. 20 pages. 20 cents. Safe handling and use.

Phosphorus Trichloride. Chemical Safety Data Sheet SD-27, published by Manufacturing Chemists' Association, 246 Woodward Bldg., Washington 5, D. C. 16 pages. 20 cents. Safe handling and use.

Pigments for Paper Coating. TAPPI Monograph Series—No. 7, published by Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York. 135 pages. Discussions of ten individual coating pigments.

A.S.T.M. Standards on Bituminous Materials for Highway Construction, Waterproofing and Roofing. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. 306 pages. $3. Specifications, methods of testing, definitions.

Your Guide to Safety in Welding and Cutting Operations. Published by the Association of Casualty & Surety Cos., 60 John St., New York. Describes safe methods of operation and safe handling of equipment in gas welding and cutting and in electric arc welding.

Transactions of The Electrochemical Society. Vol. 91-1947. Published by the Electrochemical Society, Inc., Columbia University, New York, N. Y. 724 pages. $6.50.

Stable Isotopes. Published by the U. S. Atomic Energy Commission, Isotopes Division, P. O. Box E, Oak Ridge, Tenn. 8 pages. Covers hydrogen 2, boron 10, oxygen 18, mercury 198, carbon 13 and nitrogen 15.

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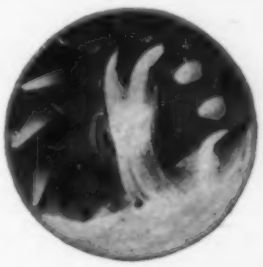

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Laramie Sponge-Iron Pilot Plant. By T. L. Johnston and W. M. Mahan. Bureau of Mines Report of Investigations R. I. 4376. Mimeographed. A resume of 40 tests conducted during the late war period.

Methods Used in Evaluating Adsorbent Clays. Bureau of Mines Information Circular I. C. 7475. Mimeographed. Report on laboratory-scale studies and recommended procedures.

A Process for the Production of Iron-Free Alum. Part 2. Pilot-Plant development. By William K. Cunningham, et al. Bureau of Mines Report of Investigations R. I. 4351. Mimeographed. Extended report on pilot plant investigation at the College Park, Md., station.

Mercury Resources of Japan. U. S. Bureau of Mines, Special Supplement No. 24 to Mineral Trade Notes. Mimeographed.

Recovery and Utilization of Pulp From White Potato Starch Factories. By Roderick K. Eskew, et al. Bureau of Agricultural and Industrial Chemistry, AIC-204. Processed.

Marketing and Manufacturing Margins for Hides and Skins Leather and Leather Products. By L. D. Howell. Bureau of Agricultural Economics, Technical Bulletin No. 961. A statistical study of trade practice. Price 20 cents.

Soybean Studies. The staff of Northern Regional Research Laboratory, Peoria, Illinois, has issued a series of documents for presentation at Cooperative Soybean Conference last summer, including: AIC-194—Fractionation of Soybean Oil by Liquid-Liquid Extraction; AIC-195—A Pilot Plant for Solvent Extraction Studies; AIC-196—Alcoholic Extraction of Oil from Soybeans; AIC-197—Food Uses for Soybean Protein; AIC-198—Edible Soybean Oil; AIC-199—Paints from Soybean Oil; AIC-200—Developments in Soybean Research at the Northern Regional Research Laboratory; AIC-201—Composition and Its Effects on the Price of Soybeans and Soybean Oil.

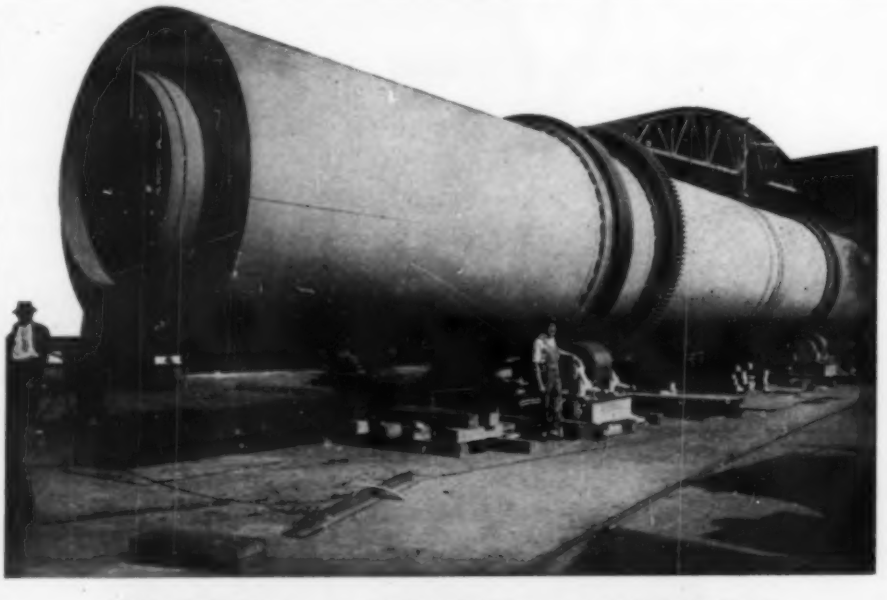
Federal Government Funds for Education. Office of Education, Leaflet No. 79. Summary of money furnished by the Federal Government to assist in educational processes during the two college years 1946-47 and 1947-48.* Price 15 cents.

Statistics of Land-Grant Colleges and Universities. Office of Education, Bulletin No. 14 of 1947. Data for the year ending June 30, 1946. Price 15 cents.

Selling to the Navy. Navexos P-548. A pamphlet of Navy Department "published particularly for the assistance of the smaller business concerns of the United States" who have contract dealings with the department. Price 15 cents.

United States Government Manual, 1948. Describes functions and operations of government departments and independent agencies. Price $1.

Collective Bargaining Provisions. Bureau of Labor Statistics series of pamphlets of which the general covering booklet was issued about a year ago. Parts dealing with various phases of industrial labor relations are currently available as follows: Bulletin 908-2—Vacations;



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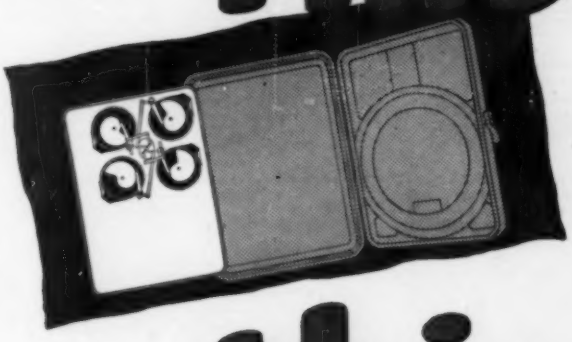

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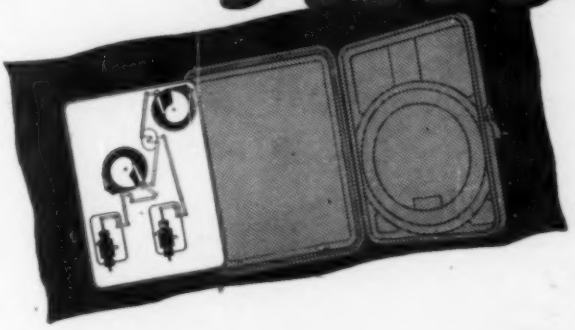

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P-18

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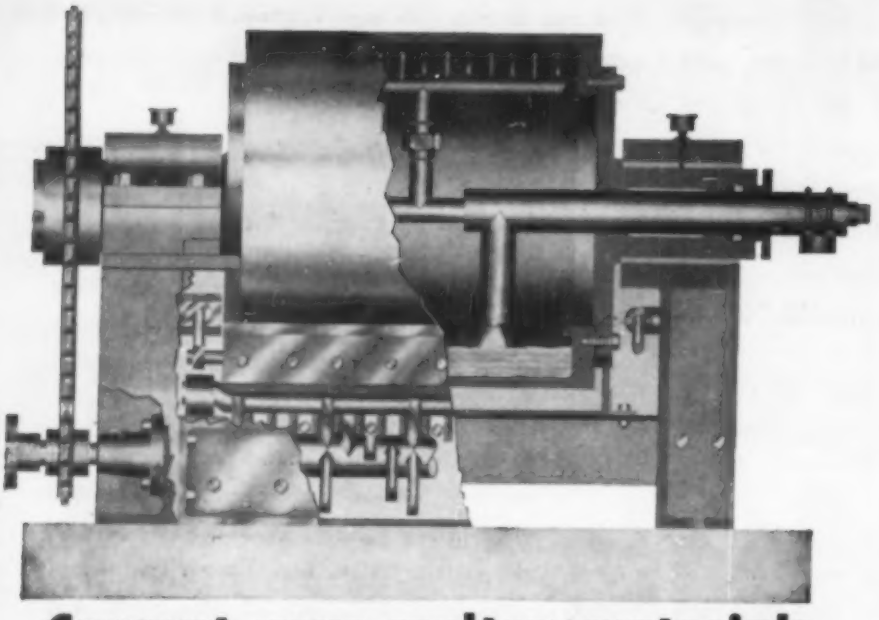

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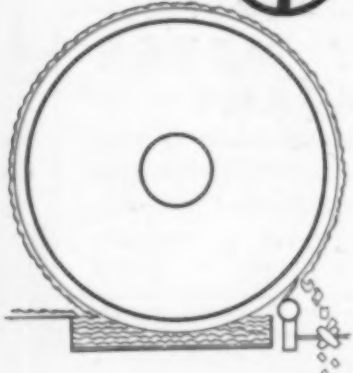

The Goslin-Birmingham Flaker is used to advantage in the manufacture of acetanilide, ammonium benzoate, benzoic acid, calcium chloride, naphthalene and many other materials which are produced in molten form and solidify upon cooling.

The flaker shown above is one of the several types produced in our modern plant. G-B Flakers are manufactured to standard specifications, or to meet your specific requirements. They are available in all materials of construction, and can be provided with vapor-tight hood if required. Write for complete details.

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Holidays, and Week-End Work. Price 15 cents; Bulletin 908–3—Incentive Wage Provisions; Time Studies and Standards of Production. Price 20 cents; Bulletin 908–4—Apprentices and Learners. Price 15 cents; Bulletin 908–5—Discharge, Discipline, and Quits; Dismissal Pay Provisions—Price 20 cents.

Economic Cooperation Administration. First and Second Quarterly Reports to Congress. These cover quarters ending June 30 and September 30 of this year. They summarize policy and give statistical resume of actual proceedings.

Ruling Inks and Dyes. GPO-PIA Joint Research Bulletin I-1. This is one of a series of pamphlets summarizing the results of cooperative studies of Government Printing Office and Printing Industry of America, Inc. Price 10 cents.

Measurement of Radioactive Isotopes. National Bureau of Standards, Circular 473. A manual for use by those handling samples or instruments for measuring radioactivity. Price 5 cents.

Bibliography of Some Recent Research in the Field of High Polymers. National Bureau of Standards, Letter Circular LC922 (Supersedes LC871 and Supplement). Mimeographed.

Annotated Bibliography of Papers on Geochemical Prospecting for Ores. U. S. Geological Survey, Circular 28.

Statistics of Electric Utilities. Federal Power Commission, Washington 25, D. C. Cloth bound. Order only from the Commission as FPC-S-6b. Price $2.

Mineral Preprints. The various chapters from Minerals Yearbook 1947 will be issued by the Bureau of Mines in pamphlet form, frequently with several chapters grouped together under one cover. Those wishing preprints of chapters on specific subjects can request these of the bureau which will from time to time furnish information as to availability. Mailing of separate individual chapter preprints will not be made during the coming winter.

Minerals Yearbook 1946. U. S. Bureau of Mines. Cloth bound. This is the assembly of the 1946 preprint chapters previously issued as separate pamphlets. Price $3.75.

Analyses of Complex Mixtures of Gases. By S. H. Ash and E. W. Felegy. U. S. Bureau of Mines, Bulletin 471. "Application to control and extinguish fires and to prevent explosions in mines, tunnels, and hazardous industrial processes." Price 75 cents.

Analyses of Michigan, North Dakota, South Dakota, and Texas Coals. U. S. Bureau of Mines, Technical Paper 700. An extended tabulation of data of analyses of coals and lignites from all fields in the four states named.

Laboratory Study of the Hot-Water Process for Separating Hydrocarbons From Surface Deposits of Bituminous Sandstones Near Edna, Calif. By G. B. Shea and R. V. Higgins. Bureau of Mines, Report of Investigations R. I. 4246. Mimeographed.

Natural-Gasoline and Cycle Plants in the United States, January 1, 1948. By F. S. Lott and E. M. Seeley. Bureau of Mines Information Circular I. C. 7488. Mimeographed. A directory of existing establishments.

Ignition of Firedamp by Explosives. By Bernard Lewis and Guenther Von Elbe. Bureau of Mines Report of Investigations R. I. 4382. Mimeographed. A resume of experimental work and fundamental science underlying.

Inversion of Sucrose and Other Physiological Changes in Harvested Sugarcane in Louisiana. By John I. Lauritzen, et al. U. S. Department of Agriculture, Technical Bulletin No. 939. Price 25 cents.

Bookbinding Leather. GPO-PIA Joint Research Bulletin, Bindery Series No. 5. Price 15 cents. Includes suggested specifications and methods for use.

Pyroxylin-Treated Book Cloths. GPO-PIA Joint Research Bulletin, Bindery Series No. 7. Price 15 cents. Includes suggested specifications and methods for use.

TWIN TOOL STEELS

Midvale Diamond Brand and Diamond-A high carbon, high chrome tool steels meet customers' requirements for tools with high hardness, resistance to abrasion and minimum deformation. They differ in this respect: air hardening Diamond-A is somewhat more machineable and slightly less resistant to abrasion than oil hardening Diamond Brand. Both can be forged, as well as machined. They have a wide variety of application, including dies, rolls, punches, gauges, saws, paper mill knives, hobs, etc. Either can be depended upon to the limit.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

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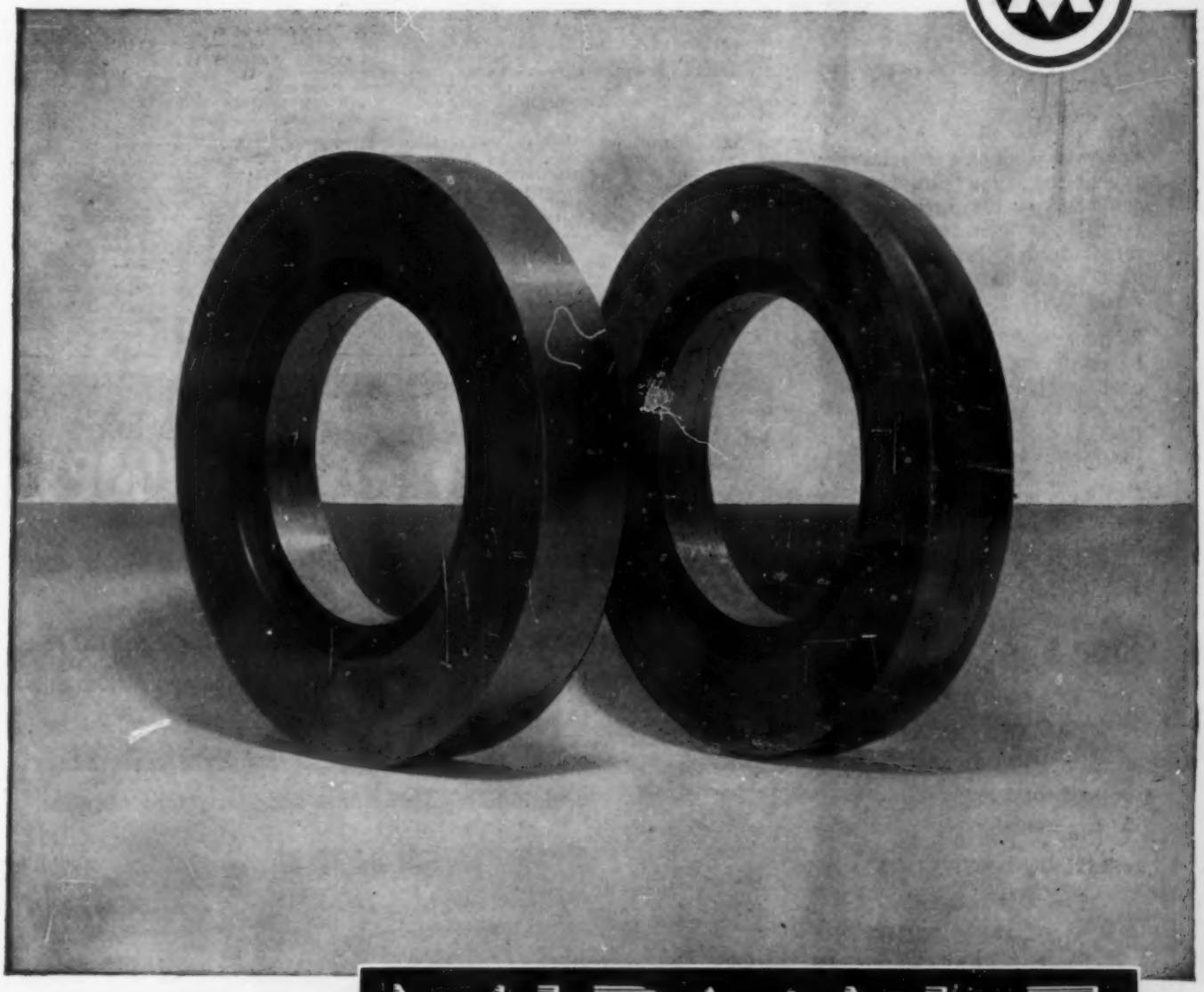

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FORGINGS AND RINGS

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SCRUBBING CORROSIVE GASES ?

Fig. 645

Are your scrubbing nozzles as efficient as you think they *could* be? Do they resist the corrosion or wear conditions satisfactorily? Produce the breakup and distribution you would like?

Right now thousands of Monarch Fig. 645 nozzles are scrubbing all kinds of gases all over the world .... Perhaps they can do a *better* job *for you!*

Outline your spray problem for us—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

- OIL ATOMIZING
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Write for Catalogs 6-A and 6-C

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2513 E. ONTARIO ST.
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MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Reader's Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 159-160.

(*Continued from page 160*)

perature, pH, electrolytic conductivity and gas analyses.

113. Insulation. Pittsburgh Corning Corp., Pittsburgh, Pa.—4-page brochure No. 37-B illustrates applications for the cellular glass insulation produced by this company. The brochure particularly emphasizes the applications of this type of insulation for cold storage rooms.

114. Lubricator Valve. Titeflex, Inc., Newark, N. J.—New 8-page bulletin describes the method of operation and applications for the lubricator valves produced by this company. Sizes of valves produced and accessories are also shown.

115. Hydraulic Remote Control. Sperry Products, Inc., Danbury, Conn.—8-page bulletin No. 2001 illustrates the types of remote control mechanisms produced by this company which operate hydraulically. Both single and multiple control systems are shown and specifications are given.

116. Metallizing. Metallizing Engineering Co., Long Island City, N. Y.—8-page catalog No. 401 lists the various types of metallizing equipment produced by this company. Included are not only metallizing guns but also the required accessory equipment, such as air and gas controls, spray booths and dust collectors, blast machines and nozzles and air compressors.

117. Air-Driven Pumps. Milton Roy Co., Philadelphia, Pa.—4-page bulletin No. 488 describes the new controlled volume pump with rotary air or gas type of drive which this company produces. Applications and specifications for these pumps are listed.

118. Water Treatment. Bird-Archer Co., New York, N. Y.—20-page booklet describes the various types of water treatment necessary for such systems as boiler feedwater, condensate return systems, cooling systems, and air conditioning systems.

119. Flow Measurement. Hagan Corp., Pittsburgh, Pa.—10-page booklet T-100-M gives capacity data for concentric orifices and flow nozzles. Through the use of the charts given in the bulletin the correct size of orifice or flow nozzle may be chosen for any particular fluid flow measurement. Several examples are given.

120. Thermometers. Electric Auto-Lite Co., Toledo, Ohio—4-page bulletin illustrates the various types of indicating and recording thermometers produced by this company. The instruments shown cover temperature ranges from —40 deg. to +750 deg. F.

121. Valves. Grove Regulator Co., Oakland, Calif.—Two new bulletins describe the expansible tube valves produced by this company. Bulletin No. 800-B describes the various manual and automatic remote control applications of the valve. Bulletin 610-B describes the operation and performance of check valves of the expansible tube type.

122. Conveyor. Rapids-Standard Co., Grand Rapids, Mich.—2-page bulletin describes and illustrates the power belt conveyor produced by this company. The

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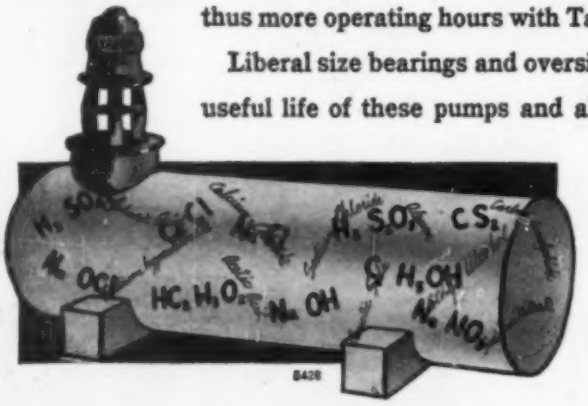
Oleum, concentrated sulphuric, mixed acids and similar liquids, are well within the handling range of Taber Vertical Pumps.

By locating the stuffing box away from fluid being handled, repacking interruptions are reduced to an inconsiderable minimum . . . thus more operating hours with Taber Vertical Pumps.

Liberal size bearings and oversize shafts extend the useful life of these pumps and also retard vibration.



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TABER PUMPS for Higher Practical Performance

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PROCESSING
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EVAPORATORS, DRYERS, SOLVENT
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for Rapid Sand Filters . . .

Superior to conventional filters, these porous bottoms assure improved filtration, considerably longer filter runs and ability to pass increased rate of flow. Containing no layers of graded gravel, they permit repairs and inspections to be made readily and without the heavy cost of handling the sand and gravel.

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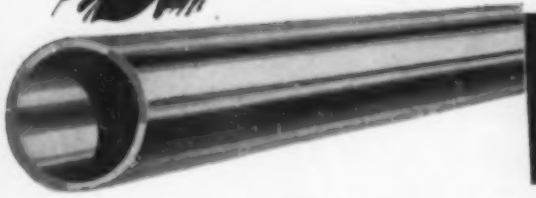
CORROSION-RESISTANT LIGHTWEIGHT TUBING



AVAILABLE NOW IN MANY ALLOYS, IN A COMPLETE RANGE OF SIZES

For lightweight, high-strength, corrosion-resistant tubing, you're 'way ahead with WELDCO. WELDCO is made by tubing specialists . . . experienced men who *know* their product and have *complete* mill facilities at their disposal. It's properly formed, carefully finished, rigidly checked right down the line, to give you a product that's mechanically and metallurgically sound.

WELDCO tubing is available in Monel, Stainless, Inconel, Nickel and other alloys, in most sizes from 3/8" to 30" O. D. Write today for your free copy of the new WELDCO booklet.

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conveyor is especially designed for interfloor conveying and because of standardization in manufacture is claimed to be low cost.

123. Flexible Couplings. James Manufacturing Co., Chicago, Ill.—8-page bulletin describes the various types of flexible couplings manufactured by this company, and gives dimensions and list prices for them.

124. Mill Maintenance. Strout, Waldron & Co., Muncy, Pa.—A 2-page operation and maintenance card has been issued by this company to aid operators of the company's double runner attrition mill. Approved methods for various maintenance jobs and lubrication are given.

125. Plastics Check Chart. Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.—A check chart has been made in slide-rule form showing the physical properties and various applications for the phenolic plastics manufactured by this company. The slide-rule also gives the specific gravity of various structural materials for comparison with the plastics.

126. Nickel Alloy Castings. International Nickel Co., New York, N. Y.—32-page booklet entitled "Nickel Alloy Steel Castings in Industry" gives examples of the various applications for nickel alloy castings used in industry in general. The section on chemical equipment highlights such things as valve bodies and pump casings.

127. Chemical Catalog. Sindar Corp., New York, N. Y.—8-page price list and catalog gives the prices and brief specifications for the various industrial aromatics and chemicals produced by this company. Germicides, fungicides, stabilizers, anti-oxidants and anti-skinning agents are included.

128. Temperature Control. Leeds & Northrup Co., Philadelphia, Pa.—36-page catalog ND4A(2) presents data on the duration-adjusting type of regulating temperature control produced by this company for use in regulating temperatures of electric furnaces, salt pots, and certain fuel-fired furnaces. Actual applications and results are included.

129. Karbate. National Carbon Co., New York, N. Y.—Catalog section M-88003 gives detailed engineering information on Karbate pipe and fittings. Comprehensive tables of the physical properties of the material are included.

130. Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—4-page Bulletin No. 51B6145A describes the advantages to be gained by using the explosion-proof motors produced by this company. Advantages mentioned include lower installation, insurance and maintenance cost.

131. Crusher. Pennsylvania Crusher Co., Philadelphia, Pa.—4-page bulletin No. 8002 describes the impact crusher produced by this company. Specifications are given for the units which vary from capacities of 500 to 6,000 lb. Particles produced by the unit may be in sizes down to 10 mesh.

132. Transformers. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—16-page booklet No. 61X7088 gives recommended methods for the installation and operation of dry type transformers. Improved methods of drying coil and core assemblies are given should the transformer be exposed to moisture during service.

133. Stitchers. Acme Steel Co., Chicago, Ill.—12-page bulletin entitled "Profit by Stitching" illustrates the line of metal stitching equipment produced by this company for stitching solid fiber and corrugated shipping containers. Specifications of the units available are included.

134. Alloy Steel Equipment. Electric Steel Foundry Co., Portland, Ore.—New catalog No. 168 illustrates the variety and types of products made by this company from stainless and other alloy steels. Examples of equipment shown include ball mill parts, cement kiln parts, heat exchangers, piping and stainless valves.

135. Dust Control. Sly Manufacturing Co., Cleveland, Ohio—24-page bulletin No. 98 gives design data and specifications for the dust filters produced by this company. Actual installations are pictured and methods of instrumentation

How RUGGED is RUGGED

...and is it important in an instrument?

"How rugged" an instrument is, has a great deal to do with "how long" it will remain in operation. Regardless of how accurate, sensitive or flexible an instrument may be, the value is low if the instrument goes out of service.

Our interpretation of an instrument's "ruggedness" is the ability to operate, under the most adverse conditions encountered, on applications for which it is intended.

In addition to being built to operate under outdoor conditions, the construction of the Republic Pneumatic Transmitter is more like that of a precision machine than of the sensitive instrument that it is. The design both permits and requires strength, as the force-balance principle could not be carried out with light, bendable parts. All bearings, levers, pins and other working parts must be heavy enough to carry appreciable loads and are therefore not susceptible to damage in ordinary handling or use.

We repeat—"ruggedness" is an important feature of the Republic Pneumatic Transmitter.

★ ★ ★

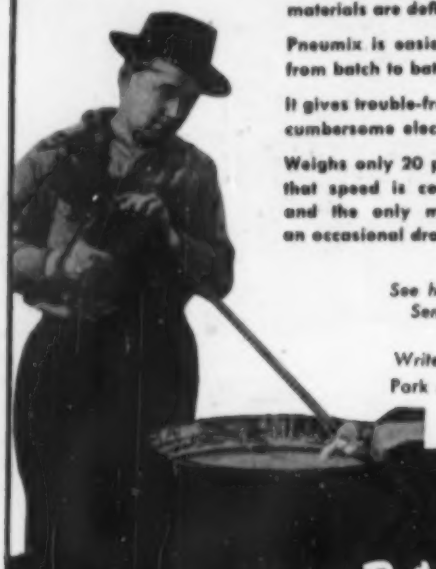
The Republic Transmitter is a pneumatic metering device. It employs the force-balance principle to convert process variables such as flow, liquid level, pressure or liquid density, into air pressures which vary proportionally with the process variables.

These air pressures become direct measurements and can be conducted to reading instruments or used as the measuring impulse for the actuation of an automatic controller.

For complete details write for Data Book No. 1001

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois



Batch mixings of all types of materials from water-thin to heavy materials are definitely easier *with Pneumix.*

Pneumix is easier to handle—easier to operate—easier to carry from batch to batch—easier to maintain.

It gives trouble-free, efficient performance. Does the job of heavy, cumbersome electric mixers and without explosion hazards.

Weighs only 20 pounds. Construction is rugged yet so simplified that speed is controlled by a single, accessible air throttle—and the only maintenance required is the easy cleaning and an occasional drop of oil.

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See how Pneumix is serving many industries. Send for a copy of "Pneumix in Action."

Write ECLIPSE AIR BRUSH COMPANY
Park Avenue near 14th St., Newark 7, N. J.

EASIER BATCH MIXINGS with SIMPLIFIED, PORTABLE PNEUMIX AGITATORS

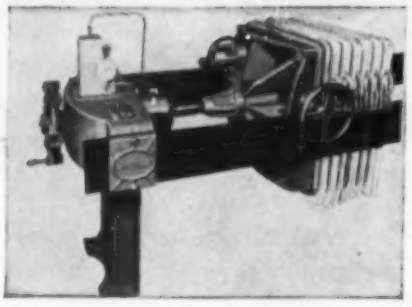
PNEUMIX DIVISION
ECLIPSE

CUTS TIME · LABOR · TROUBLE IN CLOSING FILTER PRESSES

SHRIVER
HYDRO-KLOSER

Here is a simple, rugged filter press closing mechanism that replaces manually operated ratchet or gear and pinion closing. Easily installed at moderate cost and without alterations on existing Shriver filter presses or with slight modifications on other makes, the Hydro-Kloser definitely reduces time and labor. It ends the strenuous, unpleasant work in manual closing and hazards to workman of possible slipping, falling or wrenching.

The Hydro-Kloser will pay for itself in just a few months of man-hour savings, in faster operating cycles and in reduced supervision and maintenance. Write for Bulletin 128.



This hydraulic closing mechanism consists of a compact ram assembly that is quickly and easily installed in the screw standard, and a small hydraulic hand pump bolted to the top. A few strokes of the pump lever brings the closing pressure to required tightness.... It takes but a couple of minutes.... Releasing the pressure is just as quick and easy, freeing the filter assembly for access to the plates.

T. SHRIVER & COMPANY, Inc.
802 Hamilton St. Harrison, N. J.

Shriver FILTER PRESSES

are shown. Capacity ratings for the standard sizes of filters manufactured are included.

136. Conical Blenders. General Machine Co. of New Jersey, Newark, N. J.—4-page brochure illustrates the specifications and applications for the conical blenders produced by this company. The unit is completely contained in that supports and motor drives are built in.

137. Steam Jet Blowers. Schutte & Koerting Co., Philadelphia, Pa.—12-page bulletin 4-AB describes the steam jet blowers and blast nozzles produced by this company for moving large volumes of gases at low pressure. Complete specification data are given on the various types of units and typical applications are shown.

138. Heat Exchanger. Manning & Lewis Engineering Co., Newark, N. J.—4-page bulletin describes the various type of heat exchange equipment produced by this company. Equipment listed other than straight heat exchangers includes jacketed kettles, condensers, pressure vessels and autoclaves.

139. Pumps. Duriron Co., Dayton, Ohio.—20-page bulletin No. 815 describes the series of centrifugal pumps built by this company specifically for applications where high corrosive conditions are encountered. Complete details of the construction of the pumps are shown. Materials of construction can be either high silicon iron or stainless, nickel base and ferrous alloys.

140. Conveyors. H. J. Ferguson Co., Jenkintown, Pa.—24-page bulletin No. 201 illustrates the various types of gravity wheel conveyors produced by this company. Angled and circular types of wheel conveyors are shown as well as flat-bed types.

141. Chlorine Handling. Mathieson Chemical Corp., New York, N. Y.—36-page booklet provides information on the proper handling of liquid chlorine. The booklet contains information on the physical properties of chlorine as well as safety information on its handling.

142. Screens. Cleveland Wire Cloth & Mfg. Co., Cleveland, Ohio—4-page Bulletin No. 7 illustrates strainer and filter elements which can be produced from wire screen. The various size screens which are available are listed.

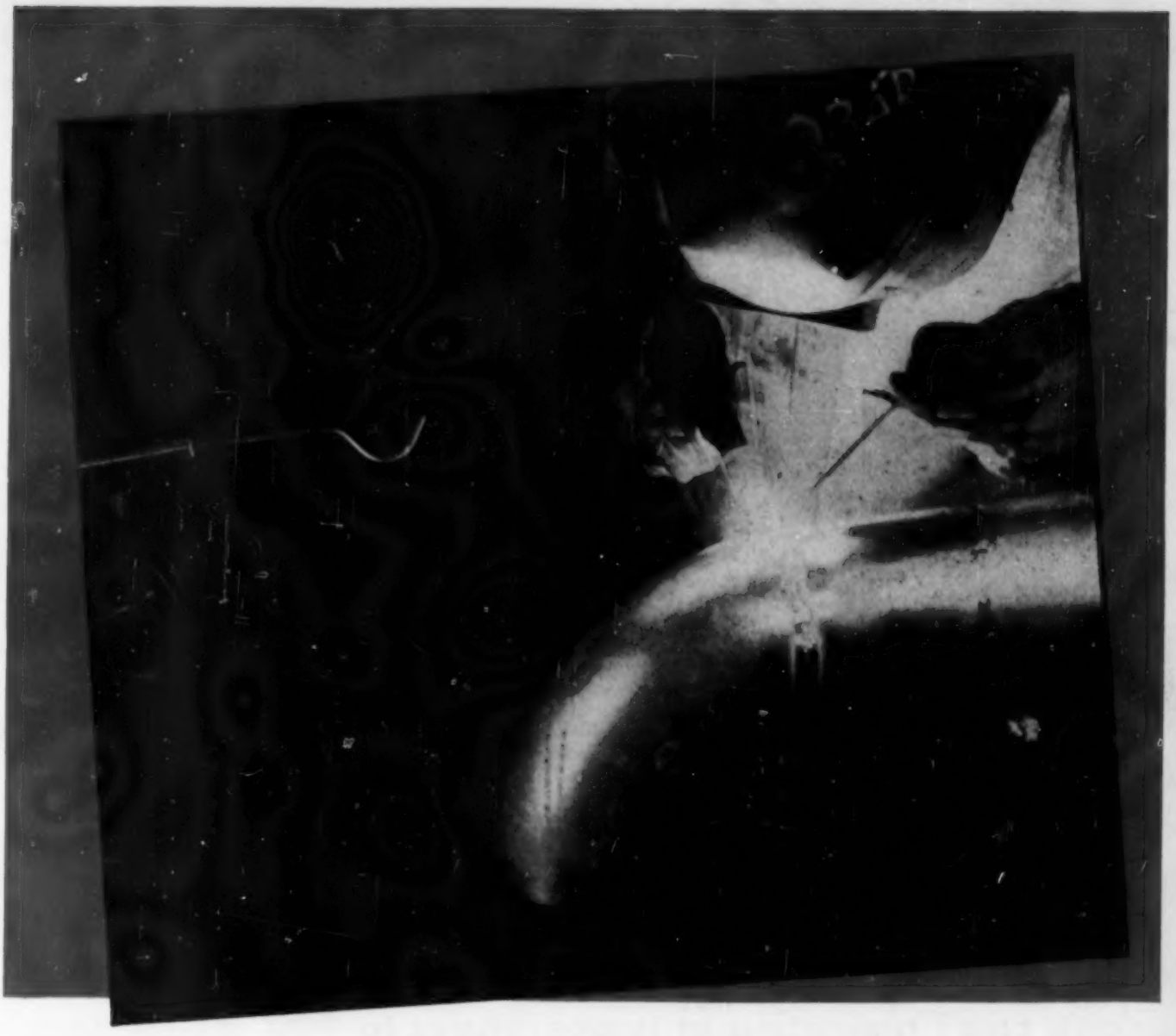
143. Instruments. Automatic Temperature Control Co., Philadelphia, Pa.—8-page bulletin R-10 gives detailed engineering and application data on the new pressure indicating instrument produced by this company. Measurements are electrically transmitted with claimed accuracies of ¼ of one percent.

Requests for the following publications must be on company letterhead and sent directly to the manufacturer.

Aluminum Alloys and Mill Products. Reynolds Metals Co., 2500 South Third St., Louisville 1, Ky.—162-page book gives complete specification data on the various aluminum alloys and mill products produced by this company. Physical, chemical and mechanical properties are given together with instructions on proper methods of fabrication and heat treatment.

Hard Rubber and Plastics. American Hard Rubber Co., 11 Mercer St., New York 13, N. Y.—56-page handbook gives data on the physical and electrical properties of the hard rubber and plastics produced by this company. Dimensions of available hard rubber rods and tubes are given and the design technique for molding hard rubber is discussed. Information is given on the machining and finishing of hard rubber articles.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 159-160



Al...symbol of piping progress

LITTLE wonder that aluminum is being more and more widely used in the petroleum and chemical industries for a long list of piping applications. It's light in weight, has excellent corrosion resistance and thermal properties.

Aluminum may be used to handle some fluids in which other metals or alloys may cause undesired catalytic reactions. And, where mild corrosion occurs, no color contamination results. It resists corrosive attack from hydrogen sulphide, sour crude oils, minerals, and liquid fuels, and has been successfully employed on gas and oil transmission lines at pressures up to 1,000 psi.

Write for the new folder, "Tube-Turn Aluminum Welding Fittings and Flanges". You'll find complete data about every item in the line and helpful information about various aluminum pipe welding methods. Sure, aluminum piping can be welded successfully!

Tube-Turn welding fittings carry the No. 1 trade name in welding fittings. They're available in a wide range of types, sizes, metals and alloys. For good service in good connections, specify "Tube-Turn".

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WELDING FITTINGS AND FLANGES

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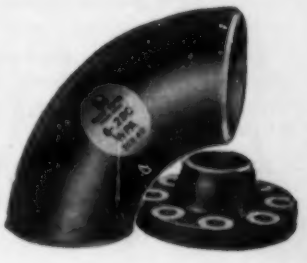


Johns-Manville Announces

For insulating refrigerating equipment, tanks, vessels, and pipes operating at temperatures to 400° below zero

FOR MORE THAN 75 YEARS, insulations by Johns-Manville have kept pace with the scientific and engineering advancements of industry. Now the Johns-Manville Research Laboratory has developed Zerolite*, an entirely new inorganic refrigeration insulation.

Zerolite is recommended for use in industrial locations where the fire problem is particularly dominant and where solvent fumes may cause costly deterioration of the insulation. It is recommended for use where a dependable insulation with low heat conductivity is important in keeping a system operating economically at constant low temperatures.

Zerolite is easily worked, easily applied, and comes in sheets, lagging, and pipe insulation form, in a wide variety of sizes and thicknesses.

ZEROLITE SHEETS AND LAGGING

Zerolite sheets and lagging are made from mineral wool and a resin binder. A special J-M process disperses the resin binder over the mineral wool fibers, resulting in an insulation with exceptional moisture resistance.

ZEROLITE PIPE INSULATION

Zerolite pipe insulation is manufactured from the same materials as the sheets and lagging, but is further provided with an asphalt-saturated jacket that protects both longitudinal joints. The jacket reduces the need for seam-filling compounds and shortens application time because on smaller size lines complete sections can be applied as units. Zerolite Pipe Insulation is furnished with all accessories required for application.

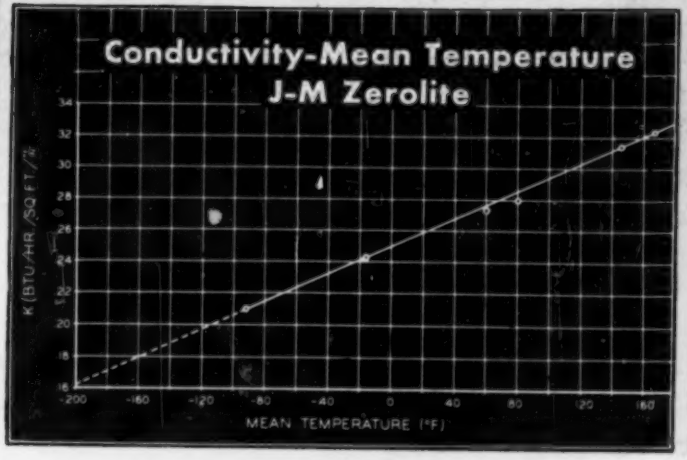
APPLICATION SERVICE

In probably no other field is correct application of insulation so important to satisfactory performance as it is in refrigeration work. Johns-Manville Insulation Application Units are staffed with insulation engineers and skilled mechanics trained in the correct application of insulating materials for refrigeration service. These contract firms are ready to help you solve your insulation engineering and application problems regardless of the size or type of the job.

Applying fire-resistant sheets of Zerolite insulation on oil storage tank.

For further information about Johns-Manville Zerolite write Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.



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- Walls, floors and ceilings—refrigerated rooms
- Cold distillate storage
- Cold reactors
- Settling tanks and vessels
- Chillers and exchangers
- Filters

ZEROLITE PIPE INSULATION

- Refrigerant lines
- Cold oil piping
- Brine lines
- Chilled water
- Solvent piping

TABLE OF PROPERTIES

Cohesive strength, lb. per sq. ft.	Compression, in. (load, 500 lb. per sq. ft.)	Water absorption percent by volume (submerged 24 hr.)	Moisture absorption in air (75 percent relative humidity, 96 hr.)
300.	0.030	2.0	0.0

Modulus of rupture, psi	Thermal Conductivity (MEAN TEMP.) 70°F	0°F	-70°F	Combustibility	Average weight, lb. per cu. ft.	Specific Heat	Coef. linear change with temp.
40.	.28	.25	.22	Fire-resistant	15.	0.30	2.0×10^{-6}

Johns-Manville ZEROLITE

REFRIGERATION INSULATION

Frame Style Nos. 1, 2 and 3 in
3", 4", 5", 6", and 8" sizes
Frame Style No. 0 in 2" size
New Arrival in the
FAIRBANKS-MORSE
FAMILY!
Cross-section of Frames
Nos. 1, 2 and 3. Frame
No. 0 differs slightly

Here's the new addition to the Fairbanks-Morse Pump family . . . the Figure 5520A line of side suction centrifugal pumps. These open impeller, ball bearing pumps offer a new high in performance.

Designed for economical operation at heads up to 80 feet and capacities up to 2500 g.p.m., these new Fairbanks-Morse Pumps range in size from 2" through 8". They are available for either direct drive from motors or engines or from belt drives. Their unusual compactness assures important space-saving advantages with no sacrifice of efficiency or capacity.

WHEN IT COMES TO PUMPS...

Note these important design advantages:

- Open type, single suction impeller, designed for high efficiency at moderate heads.
- Volute of close-grained cast iron with water passages so smooth that friction and back eddies are minimized.
- Deep stuffing box permits proper packing without undue tightening of the gland . . . simple, easy repacking.
- The same proved ball bearing frame construction for smooth operation and long life used in the other side suction pumps of the Fairbanks-Morse family. Bearing nearest impeller takes radial load only and is free to move endwise. Drive-end bearing takes both radial and thrust loads. Both are sealed to keep lubricant in . . . dirt and moisture out.
- One-piece, solid cast frame for long service . . . suitable for heavy duty belted or direct connected drives. Foot of frame forms a substantial base.

For all the facts on this new line of pumps, see your Fairbanks-Morse distributor or branch house pump engineer. Fairbanks, Morse & Co., Chicago 5, Ill.

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A name worth remembering

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CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

First Quarter Outlook Good as Chemical Process Industries Continue Expansion

DESPITE softening in demand fo several chemicals that recently have hit record production levels, the chemical industry along with the other branches of the process industries will chalk up a record year. However, labor problems have combined with delays in placing new plants in operation to cut into some of the expected growth in production. Latest major setback reflected in the available data is the refinery strike which began in September.

With the fertilizer business doing well, the coming production of urea by Allied Chemical and Dye Corp. at its new Ohio unit will attract considerable interest. Du Pont, the sole major domestic producer, recently completed its expansion at Belle, W. Va. Several chemical firms have considered producing this basic organic chemical from time to time, but this new unit will mark the first time another major chemical firm has built a full-scale urea plant here.

Pulp and paper industry is operating considerably above last year's levels and has risen well above its low point in July. Demand for chemicals used by this industry continues to be very strong. Increased output of chlorine, soda ash, sodium bicarbonate and other chemicals used by the paper industry has not caught up with demand, and a further growth of about 5 percent in the alkali industry is forecast by industry spokesmen.

With the continuing expansion of the chemical industry, a new factor in selecting a new plant site has been added to those economic considerations generally used. This is the problem of security from strategic bombings with atomic bombs. According to data released by the NSRB and discussed at the recent meeting of the AIChE, atomic bombs are extremely expensive, and fissionable raw materials scarce enough to make any nation use this weapon with great selectivity. Therefore, the Board suggests a simple rule to be used in determining whether a new (or existing) plant may be in an area worthy of destruction by atomic bombs. The rule: To determine if an individual plant is within a strategically located area, draw a circle with a three mile radius around the plant. Evaluate the strategic importance of the area to see if the group of plants in the circle would be a profitable target for an atom bomb. Another guide to use in measuring vulnerability, to such bombing was given by R. F. Dimmitt of NSRB. He said that industrial areas with less than 5 sq. mi. or fewer than 50,000 people will not be in danger unless they contain highly strategic warplants.

Recent surveys show that more postwar plants are being built in small towns. Only one third are in cities with populations of more than 100,000. Furthermore, 30 percent of all plants built are in communities with less than 10,000 people. This compares with 20 percent in 1940. So it appears that postwar growth of industry has generally fitted into the national security plans.

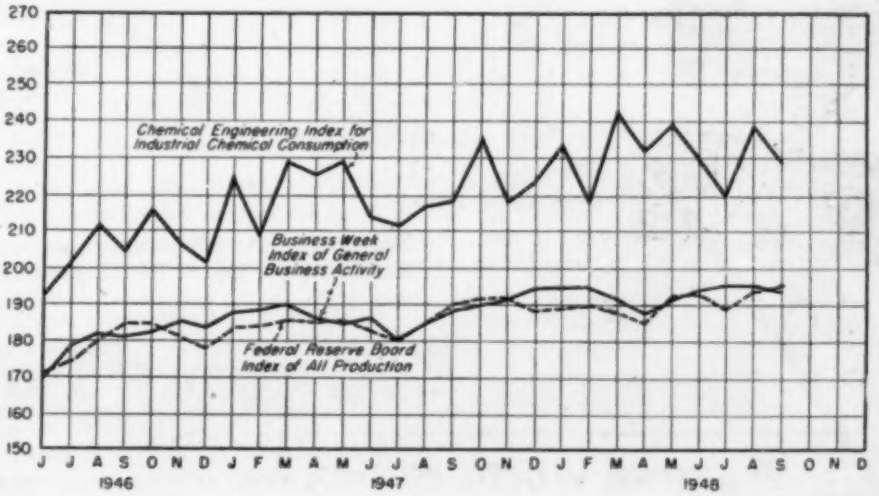
Another point that has recently given chemical plant planners considerable worry is the change in freight costs caused by the Supreme Court decision on basing point systems. This may increase the cost of plant construction in areas such as the Southwest by 15 percent. As a result, it may be more economical to build some petrochemical plants in areas closer to local consuming markets and sources of steel.

Aside from plant location problems that face chemical firms at the present time, is the greater problem of supplying the chemicals required by the high-production levels in the chemical, soap, rayon, plastics, pulp, paper, iron and steel industries. Activity in these industries shows that while there have been signs of a leveling off in some fields, no serious setback is in sight.

***Chemical-Engineering* Index**
Industrial Consumption of Chemicals

1935 = 100

	August (Revised)	September
Fertilizers	50.40	48.10
Pulp and paper	24.60	23.40
Petroleum refining	22.20	19.05
Glass	25.30	24.00
Paint and varnish	26.15	25.15
Iron and steel	12.80	13.71
Rayon	27.40	26.50
Textiles	10.48	10.75
Coal products	10.78	10.42
Leather	4.42	4.30
Explosives	9.45	9.92
Rubber	6.20	5.28
Plastics	8.26	9.34
INDEX	238.44	229.92



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Control that's *accurate* plus positive *tight closing* make Klipfel Thermostatic Valves real steam savers in operation.

Vapor pressure operated, these tank thermostats give control that's dependably sure . . . always.

Two types of single seated inner valves — both successfully proved on Klipfel's pressure reducing valves — are available for permanent tight closing:

Stainless steel ball inner valve and seat bushing with integral guides stops steam leakage, prevents wasteful, damaging overheating.

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For complete details, write Dept. BP-12 for Bulletin 446.

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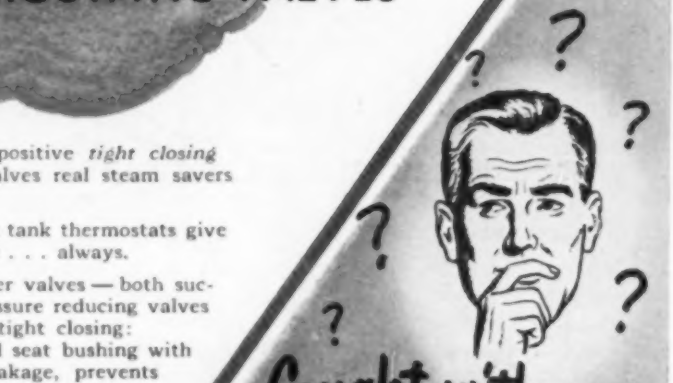
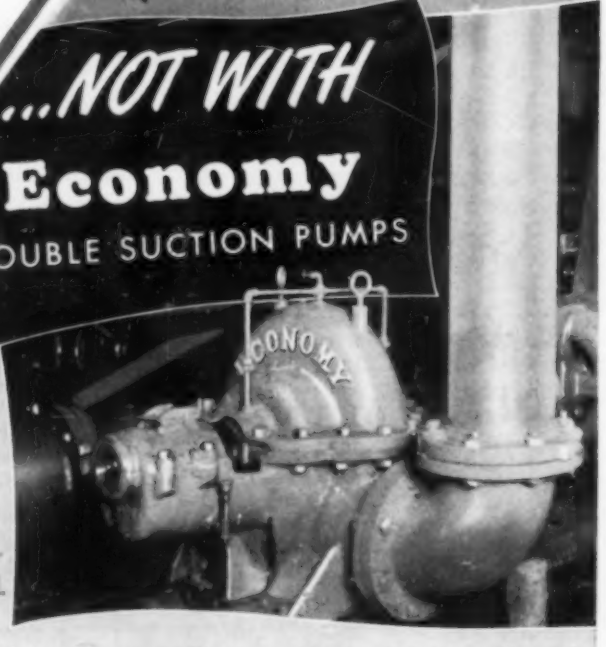


Caught with your pumps down?

...NOT WITH Economy DOUBLE SUCTION PUMPS



12 X 10" Economy Double Suction Pump in white water service, in large felt mill. 3000 g.p.m., 40 foot head.

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Economy Double Suction Pumps, illustrated, are ruggedly built for heavy mill service as well as general water supply. Advanced hydraulic design. Duplex thrust bearings mounted back to back. Effective cross lubrication to both bearings. Cartridge enclosures protect bearings . . . permitting removal of complete rotor without exposing bearings to dirt and dampness.

For the complete Economy story on Double Suction Pumps, write Dept. BP-12 for bulletin A1147.

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Economy Pumps Inc.

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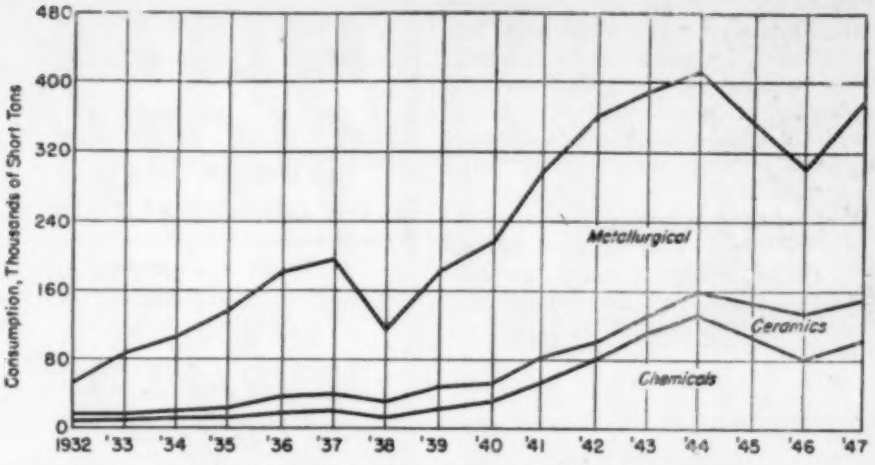

Fluorspar, raw material for fluorine and its compounds, finds bigger markets.

Fluorspar Much of it is used in metals but new fluorine compounds are pushing chemical uses higher.

A. J. P. Wilson,
Consulting Chemical Engineer

FLUORINE is the most active element now known to man. It is the most electro-negative element and hence even more reactive than oxygen. It is difficult to handle and even more difficult to keep. However, fluorine compounds are generally very stable. Fluorine was discovered by Scheele in 1771 but its commercial production for sale on the open market in elemental form is new, dating only from 1946 in this country. Chemical science has predicted a brilliant new field in the development of fluorine compounds and the forecasts are rapidly coming true.

A study of the fluorspar industry indicates that the industry is relatively small as measured by value of product. The rate of growth of the industry is not large and is rather erratic. The major consumers are the metallurgical, chemical and ceramic industries. The steel industry indicates a low rate of growth or perhaps a levelling off of fluorspar consumption. The chemical industry as well as the ceramic industry appears to offer a greater rate of growth.

Fluorine is of course closely related chemically with chlorine. The phenomenal growth of chlorine is best shown by citing its beginning in this country in about 1898 and indicating its rise to its current production of 1.5 million tons with a value of approximately $60 million. However, the raw material for chlorine is ordinary salt (NaCl) which is abundant. On the other hand, the raw materials for fluorine are as follows:

	Percent
Fluorspar (U. S. + Imports)	84
Phosphate rock	3
Cryolite (From Greenland)	13
Total	100

Fluorspar, especially the chemical grade, is currently in demand on a scale hitherto unequalled. The known resources of fluorspar are not anywhere near as abundant as salt. In fact, there has been a scramble by producers for any fluorspar deposit which is believed to be economic. Geologists are of opinion that chances are meager for discovering large resources of chemical grade fluorspar that can be mined economically at the present time.

The one other source is the extraction of fluorine from phosphate rock. Fluorine must be removed to make available phosphates for fertilizers. The United States is currently producing some 7 million tons of phosphate rock, containing from 1 to 2 percent of elemental fluorine. If this could be extracted economically it would supply from 70,000 to 140,000 tons of fluorine annually. No data are readily available on the production or consumption of elemental fluorine currently quoted at $20 per pound. The production of anhydrous and technical grades of hydrofluoric acid is given as follows:

Year	M lb.
1939	14,842
1943	45,483
1945	56,377
1946	42,900
1947	55,182

Of the new fluorine compounds, the most significant are believed to be chlorine trifluoride (ClF_3) which gives 62 percent available fluorine and sulphur hexafluoride first prepared in 1900. The latter has excellent properties for high voltage insulation. The Freons (Freon 12—difluorodichloromethane) were first produced in 1931. These refrigerants fathered the commercial development of anhydrous HF. In 1945, approximately 33,000 tons of Freons consumed about 12,500 tons of AHF. They are used also in the popular aerosol "bug bombs" in combination with DDT.

Teflon, a Du Pont plastic, with a molecular weight of about 2,000 is extremely inert, not being acted upon by any known acid, alkali, or other substance. Kellogg is making new plastic called Kel F, which is a polymer of trifluoromonochloroethylene. Other firms are working on this type of synthetic resin.

The U. S. is the world's largest producer of fluorspar, producing between 30-35 percent of the world's total. In 1947, it produced a peacetime record of 343,700 short tons valued at approximately $11 million ($33.25 per ton). This was under the wartime peak of 413,700 short tons with a corresponding value of $12½ million ($30.22 per ton).

Consumption is the important criterion. Analysis of tonnages consumed indicates that the major users are the metallurgical industries (mostly steel), the chemical and the ceramic industries. The tonnages consumed by these industries and the approximate percent of the total is shown for the years 1926-47 on the graph.

The metallurgical industry has been and is the largest user of fluorspar. However, it has been losing position to the chemical and ceramic industries. The consumption of fluorspar per pound of steel produced has been declining almost consistently over the last quarter century. It has declined from 8.2 in 1921 to 5.4 in 1946 and increased slightly to 5.5 in 1947. It is

probable that the increase in capacity of the steel industry will add to the total tonnages consumed but steel's relative percentage of the total will probably show a decline over the long term trend.

The ceramic industry has shown a relatively large growth from 1932 through 1947. The glass division of this industry consumed approximately 42,000 tons in 1947 or about 4 times its 1935-37 average. Enamel, the other major division, used about 9,000 tons in 1947 as against a 1935-37 average of 5,400 tons.

The chemical industry has shown a large growth in both tonnage and relative volume. It grew from 7,600 tons in 1926 to 129,000 tons in 1944, which was some 31 percent of total consumption. Its decline to 83,900 tons in 1946 is believed to be accounted for by declines in production for military uses and HF alkylation of petroleum. It is believed that commercial users, such as, Freons, plastics, insecticides and other new developments will increase and that the trend of consumption by the chemical industry will be definitely upward.

The average price per short ton of fluorspar shipped from U. S. mines has fluctuated from a low of $5.50 in 1915, to an all-time peak of $33.25 in 1947.

Consumers use different grades of fluorspar and pay correspondingly different prices. In the past year (1947) the average price paid by steel and iron users was about $29.04 per ton. Glass and enamel paid $35.13 and $36.20 respectively. The chemical industry paid the highest price—$40.84. In October 1948 the price for chemical grade fluorspar was quoted at $47.50.

The largest consuming areas are Pennsylvania, Ohio and Illinois. Their consumption for 1947, which is considered typical, is as follows:

State	Consumption (Short tons)	Percent
Pennsylvania	84,900	23
Ohio	62,900	17
Illinois	59,600	16
Indiana	27,900	7
New York	12,800	3
Colo., Iowa, Utah*	14,200	4
Total 8 States	262,300	70
U. S. Total	376,100	100

* Not given separately

The price structure for the past ten years has been strong, and has increased with the general rise in commodity prices. The ceramic industry pays a higher price for its fluorspar than the metallurgical industry. The chemical industry pays the highest prices.

The outlook for consumption of fluorine and for fluorspar, especially the chemical grade is excellent.

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FOR PUMPS AND VALVES

• for example:

Ciba Pharmaceutical Products, Inc., uses Pfaudler glass-line 300-gal. reactors in the Pyribenzamine plant at Summit, N. J. For more than a year these reactors have been equipped with Style #101 Plastic Teflon Packing, and Teflon Gaskets. During that time of continuous use, excellent results have been obtained. Teflon Packing and Gaskets have shown no noticeable deterioration whatsoever.

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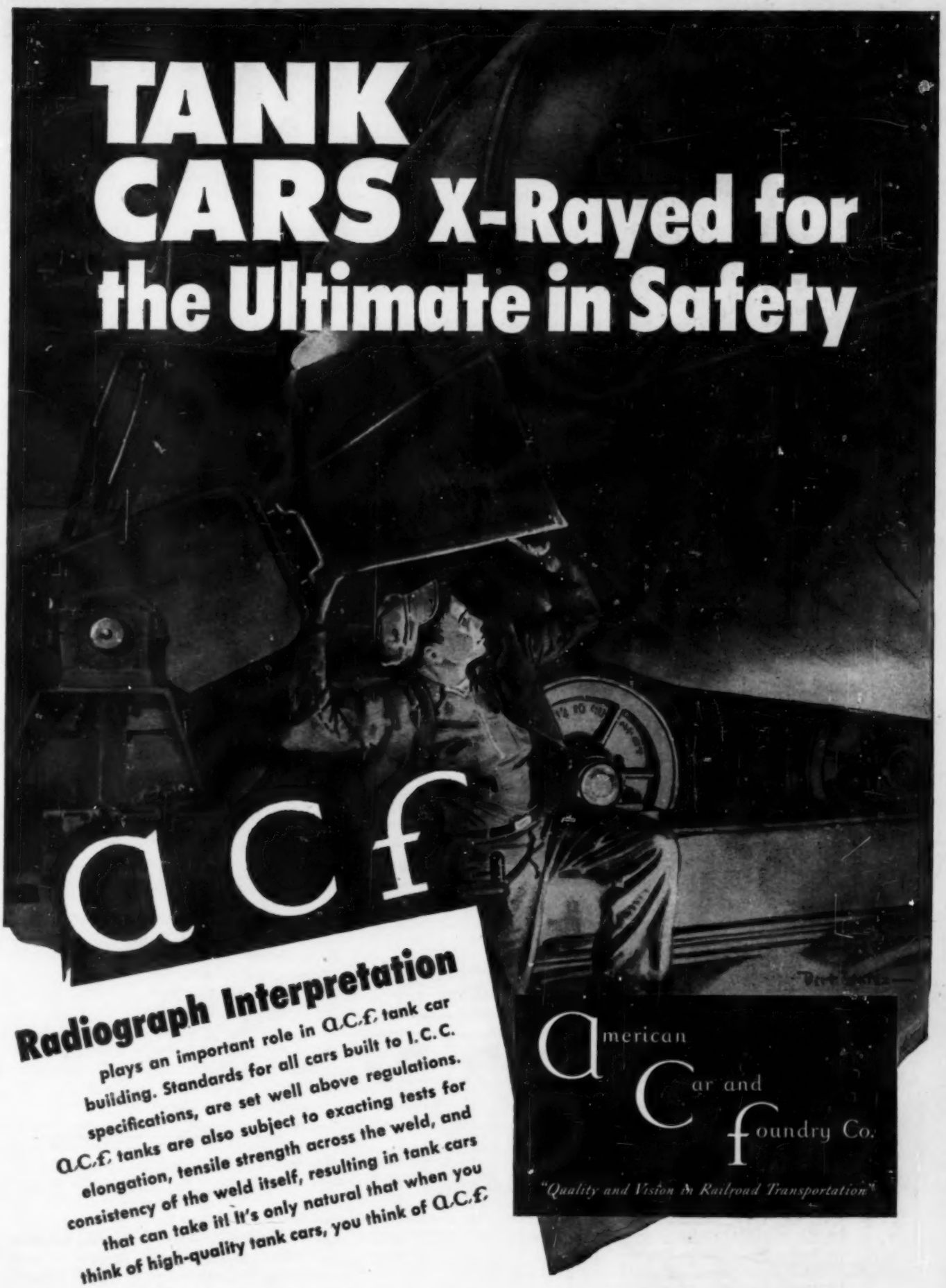

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Radiograph Interpretation

plays an important role in A.C.F. tank car building. Standards for all cars built to I.C.C. specifications, are set well above regulations. A.C.F. tanks are also subject to exacting tests for elongation, tensile strength across the weld, and consistency of the weld itself, resulting in tank cars that can take it! It's only natural that when you think of high-quality tank cars, you think of A.C.F.

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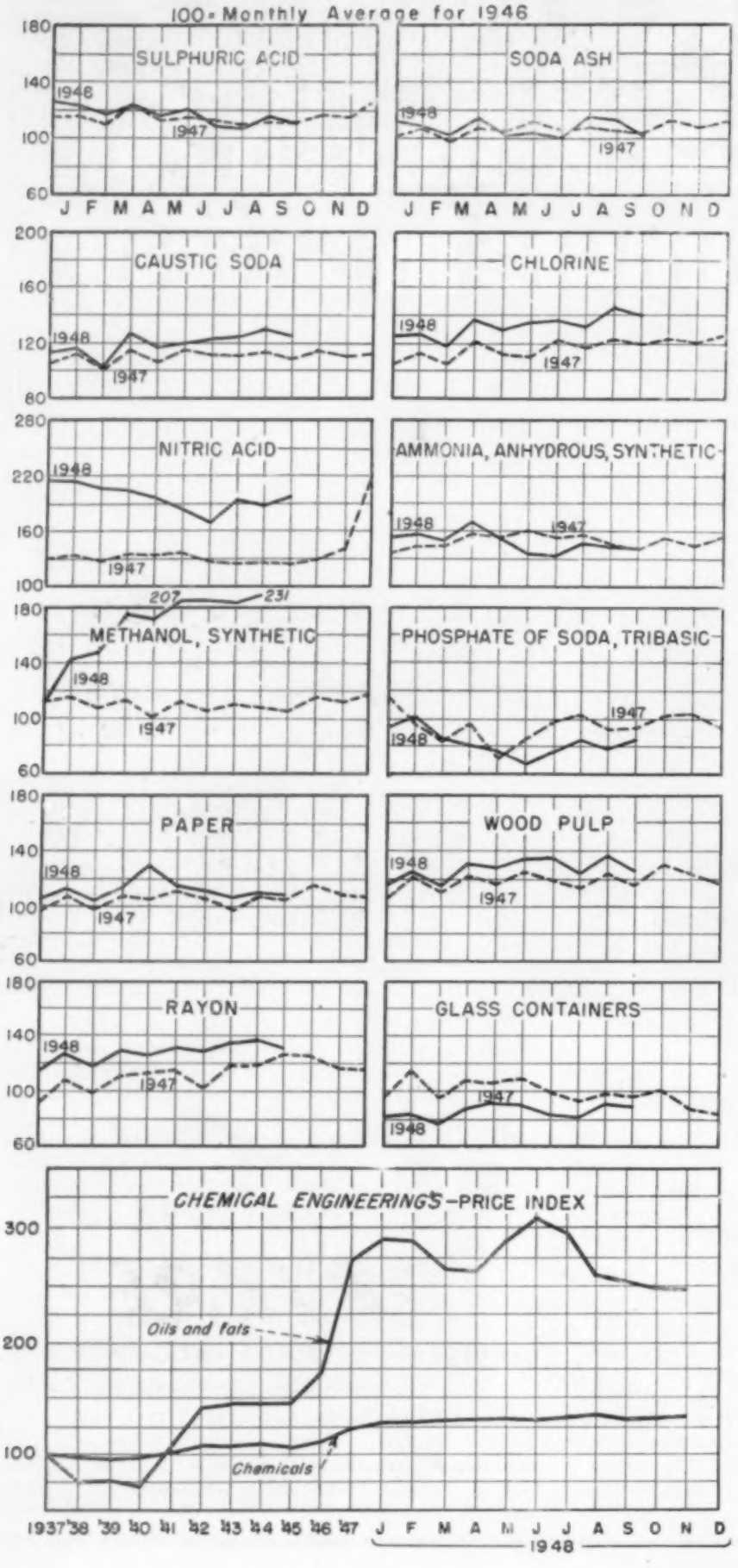
PRODUCTION, CONSUMPTION AND PRICE TRENDS



METHANOL producers have joined the firms that are entering the buyers' market that has been around the corner since the end of the war. Other organics have left the list of hard-to-get items and producers are looking for ways to reduce the ultimate cost of their product to the consumer. Celanese is shipping formaldehyde from Texas to Connecticut via tankers to beat the high rail freight rates. Du Pont is utilizing barges to move methanol and even heavy chemicals such as sulphuric acid are moving by barge. Shell is shipping acetone from Texas to New Jersey in tankers.

More nylon salt is coming. Du Pont will make it at Victoria, Tex.

Diamond has dedicated its new large alkali plant near Houston and caustic soda and chlorine from this unit should further ease the supply situation of these chemicals. Shell is reported to be having the usual plant-starting kinks in its glycerine unit with output well below capacity figures in early November. Shell officials report that the first shipments of synthetic ethyl alcohol have been made.

Nitrogen fertilizer production for the fiscal year ending June 30, 1949, will be only 2-3 percent above last year according to the National Fertilizer Association. This is due to labor troubles, plant breakdowns and conversion of some ammonia capacity to methanol production. However, enlarged existing plants and plans for new plants should add to the supply of this material.

Price Trends

Oil and fats prices dropped in December along with some chemical prices. These declines are reflected in *Chemical Engineering's* price indexes. The major drop in chemicals occurred in ethyl alcohol. On the first of the month it was down to 53½c. per gal. for the SD 1 grade. This was a drop of about 17c. in one month. Some expect it to go lower as cheap raw materials reappear on the market.

Chemical Engineering

WEIGHTED INDEXES OF PRICES

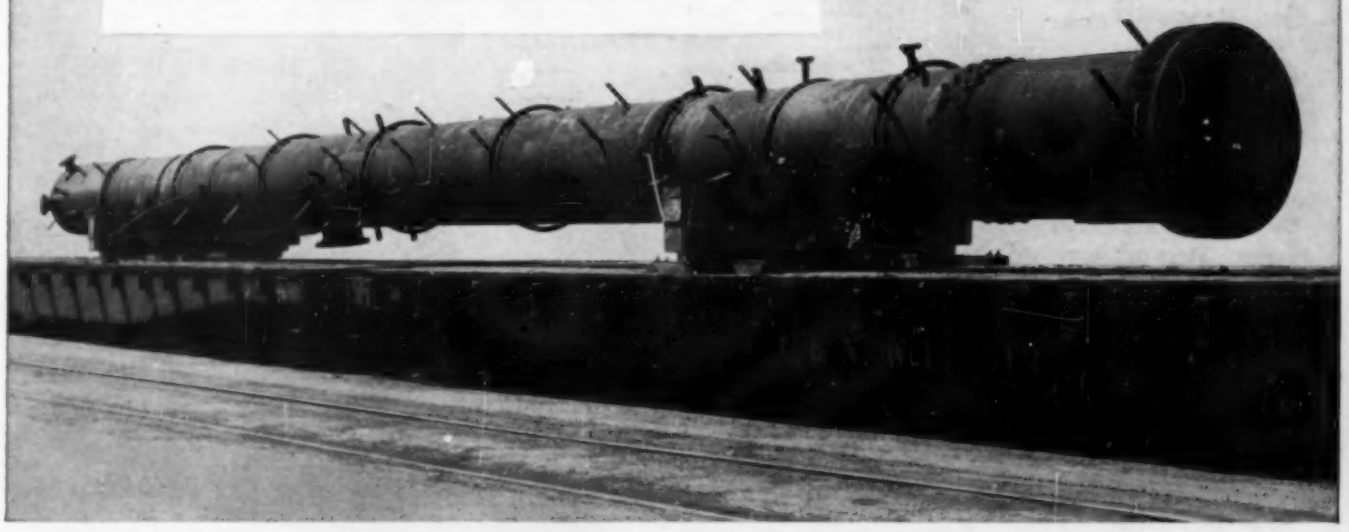
Base = 100 for 1937

	Chemicals	Oils & Fats
As of December 1	132.23	246.09
Last Month	135.25	248.23
December 1947..	128.52	304.66
December 1946..	121.23	303.07

ANOTHER WHALE OF A JOB WELL DONE

Fabricated from, and welded with, HERCULOY!

Pre-job view of Herculoy fractionating column. Overall length of this giant vessel is 88 ft. Outside diameter is 42". Shell thickness, 7/8" at bottom, becomes progressively thinner, until at the top it is only 1/4" thick. Fabricated for the petroleum industry by the John Nooter Boiler Works Company, St. Louis, Missouri. Job has now been completed. See story below.



WHEN the John Nooter Boiler Works Company received an order for the construction and installation of an 88 ft.-high, fractionating column, Nooter engineers tackled another big job.

Into this huge vessel went not only Nooter precision workmanship, but the right metal.

That metal had to have the strength of mild steel and the corrosion resistance of copper. In addition, it had to be the right metal for welding that would hold fast under stresses and strains of operating conditions.

So naturally a Revere Metal was specified, the order calling for 48,000 pounds of Herculoy.

Herculoy, you see, is not only fabricated into pressure vessels of almost any size by the conventional methods, but it can be soundly welded.

This job required 220 lineal feet of welded seam on the shell alone. The seam was manually welded with heliarc. The welds were all X-rayed, and it has been estimated that about 200 X-rays were made on this one vessel. The X-rays showed perfect welds except at two places, where it was necessary to clip out 1" sections of the weld to be done over.

The entire vessel was stress relieved at 600° F. in a 60 ft. furnace requiring annealing in two sections. Although the specifications permitted a curvature of 3/4" from bottom to top, the completed vessel was out of plumb only 1/8".

For detailed information as to just how Revere Metals may economically and efficiently serve your particular requirements contact the nearest Revere Sales Office.

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Facilities—Installed power generating equipment with capacity up to 800 KVA. Separate two-story steam plant with new 600 H.P. water tube boiler with forced draft oil burner. Adequate supply of male labor available.

Transportation—Excellent transportation facilities by rail, highway and river. 80′ x 15′ two-car railroad loading dock. Two track entrances 12′ high.

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CHAMBER OF COMMERCE
Jefferson City, Missouri

United States Production of Certain Synthetic Organic Chemicals

August 1948, August 1947, and Eight-Month Totals for 1948 and 1947

	August 1948	August 1947	Total, Eight Months 1948	Total, Eight Months 1947
Acetanilid	.....	434,895	.....	5,267,377
Acetic acid:				
Synthetic	29,323,834	32,845,382	266,839,167	249,201,160
Recovered	152,186,343	115,877,784	918,378,424	939,624,418
Natural	2,301,867	2,519,285	17,422,275	16,999,981
Acetic anhydride	62,371,131	52,518,032	492,489,196	403,221,864
Acetone	36,583,582	36,022,949	328,578,829	260,000,512
Acetylsalicylic acid	904,864	1,125,909	5,440,582	8,255,510
Aniline	7,396,590	8,920,908	65,015,204	70,185,229
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	12,758	30,711	245,258	295,820
Benzene:				
Motor grade:				
Coke-oven operators	703,792	761,111	5,659,764	11,916,099
All other grades:				
Tar distillers	821,195	1,672,542	25,229,215	15,156,893
Coke-oven operators	11,872,577	10,996,105	96,356,326	94,588,337
Butyl alcohol, primary, normal	11,089,685	12,652,412	83,854,981	96,688,250
Carbon bisulphide	33,399,130	29,501,472	267,989,130	230,510,158
Carbon tetrachloride	17,798,101	17,630,932	137,252,255	133,049,026
Chlorobenzene, mono	25,420,732	27,800,872	189,818,274	215,363,668
Creosote oil:				
Tar distillers	9,537,654	8,446,118	71,613,916	81,079,415
Coke-oven operators	2,402,674	3,541,660	28,728,445	26,307,988
Cresols, meta-para	640,143	570,400	5,907,787	4,103,899
Cresols, ortho-meta-para	873,207	844,249	5,985,326	6,457,998
Cresylic acid, refined	2,484,541	2,356,728	19,286,468	17,696,394
Dibutyl Phthalate	1,187,189	2,011,243	10,770,975	14,597,301
Dichlorodiphenyltrichloroethane (DDT)	720,769	4,066,918	10,621,225	36,077,720
Ethyl acetate, 85%	5,457,116	5,899,025	44,234,924	55,790,146
Ethylene glycol	33,496,440	20,358,381	229,536,712	139,779,499
Ethyl ether	3,069,768	2,611,072	22,777,964	28,075,858
Formaldehyde, 37% by wt.	44,080,417	38,719,233	414,429,721	348,666,646
Hexachlorocyclohexane	650,005	787,836	10,824,687	3,274,021
Methanol, natural	1,262,569	1,306,958	10,901,338	10,661,855
Methanol, synthetic	94,694,005	44,542,406	616,319,316	357,536,231
Naphthalene:				
Tar distillers, less than 79° C.	18,228,160	17,283,477	135,109,743	152,943,211
Tar distillers, 79° C. and over	6,149,598	6,398,398	66,877,977	67,024,177
Coke-oven operators, less than 79° C.	8,346,173	8,344,619	64,179,888	62,823,248
Penicillin and salts	7,379,517	2,909,204	62,898,852	22,626,531
Phenol	25,068,985	23,588,542	186,395,439	171,431,146
Phthalic anhydride	11,567,426	12,396,166	100,572,482	91,388,587
Styrene, government and private plants	34,442,949	21,254,575	245,697,298	202,526,502
Toluene:				
Coke-oven operators	2,410,169	2,248,735	18,756,767	17,310,166
All other	3,365,763	4,044,578	.....	21,427,667
Xylene, crude	4,992,399	2,293,067	34,925,966	28,268,101

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential.

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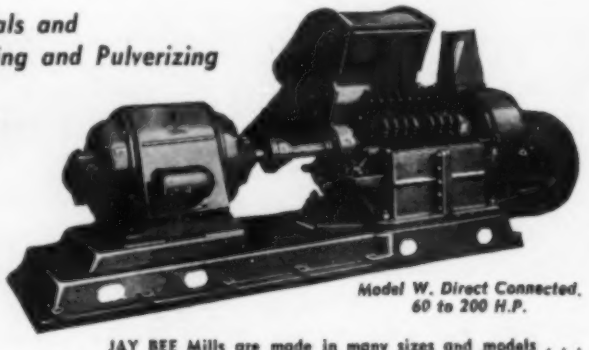

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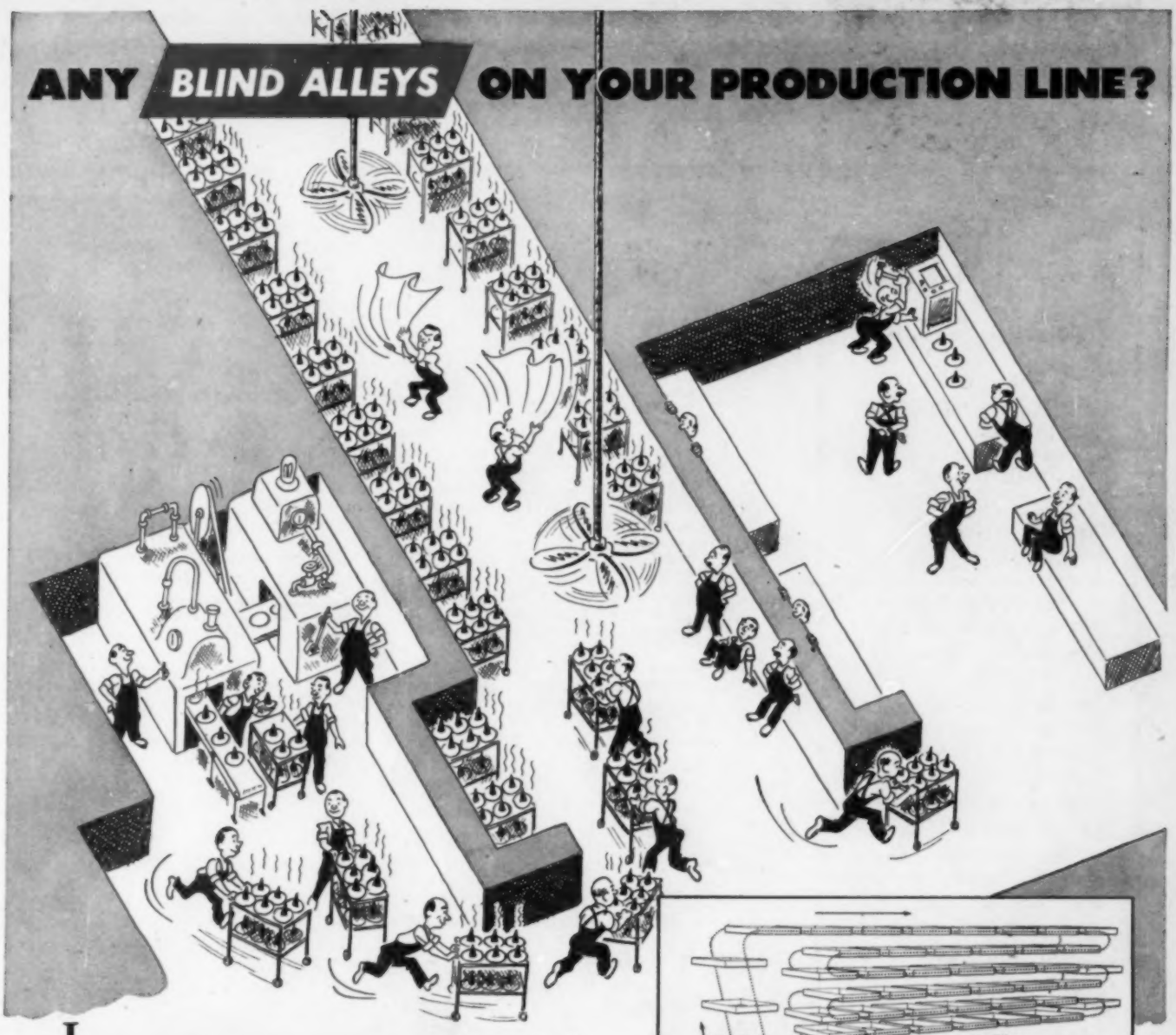

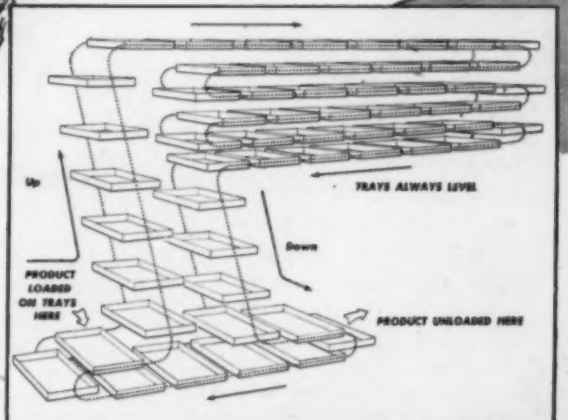

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NEW CONSTRUCTION

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$75,000	$125,000	$3,830,000
Middle Atlantic	.....	2,755,000	7,504,000	58,733,000
South	.....	4,068,000	78,353,000	101,003,000
Middle West	$2,650,000	17,380,000	15,600,000	75,236,000
West of Mississippi	9,200,000	2,190,000	176,238,000	106,232,000
Far West	.....	1,455,000	13,918,000	38,944,000
Canada	300,000	.....	90,050,000	38,789,000
Total	$12,150,000	$28,123,000	$381,788,000	$422,757,000

Proposed Work

Ill., Streator—Owens-Illinois Glass Co., Alton, plans to alter and construct 2 story addition to its factory here. Estimated cost will exceed $150,000.

N. D., Grand Forks—Summers Fertilizer Co., Stock Exchange Bldg., Baltimore, Md., plans to construct a fertilizer factory here. Estimated cost $100,000.

O., Akron—B. F. Goodrich Co., 500 South Main St., plans to construct two new additions to its factory one 2 story, 75x100 ft. and one 2 story, 175x350 ft. Estimated cost will exceed $1,000,000.

O., Cincinnati—Procter & Gamble Co., Spring Grove Ave., plans alterations and additions to its processing plant at Ivorydale. Day & Zimmerman, Inc., Packard Bldg., Philadelphia, Pa., Cons. Engrs. Estimated cost $500,000.

O., Columbus—Battelle Memorial Institute, 505 King St., Clyde Williams, Dir., plans to construct a 3 story laboratory building with space for 103 unit laboratories. Estimated cost $500,000.

O., Hubbard—Newsprint Corporation of America, c/o American Industrial Co., 68 Main St., Buffalo, N. Y., has purchased a 14 acre site here and plans to construct a newsprint mill. Estimated cost $500,000.

Tex., Agua Dulce—Panhandle Producing & Refining Co., City National Bank Bldg., Houston, Tex., plans to construct a gas compressor plant. Estimated cost $750,000.

Tex., Dallas—Lone Star Cement Co., 1st Natl. Bank Bldg., plans to enlarge its plant here to include a kiln, 150 ft. smokestack and slurry basin. Estimated cost $100,000.

Tex., Victoria—E. I. du pont de Nemours & Co., Inc., Wilmington, Del., and LaPorte, Tex., plans to construct a nylon chemical plant here. Estimated cost $8,000,000.

Tex., Dallas—Procter & Gamble Co., Spring Grove Ave., Cincinnati, O., plans outdoor alterations and additions to its plant here. Day & Zimmerman, Inc., Packard Bldg., Philadelphia, Pa., Cons. Engrs. Estimated cost will exceed $250,000.

Man., Pointe du Bois—Lithium Corp. of America, c/o Fremont F. Clarke, Rapid City, S. D., plans to construct a concentration plant for lithium carbonate at Cat Lake on the Bird River. Estimated cost $300,000.

Contracts Awarded

Ala., Sheffield—Electro Metallurgical Co., 137 47th St., Niagara Falls, N. Y., has awarded the contract for the construction of Building No. 7 to Hughes-Foulkrod Co., Schaff Bldg., Philadelphia, Pa. Estimated cost will exceed $68,000.

Calif., Berkeley—Ames-Harris Neville Co., 2800 17th St., San Francisco, has awarded the contract for a 1 story paper bag manufacturing plant to Parker, Steffens & Pearce, 135 South Park St., San Francisco. Estimated cost $306,900.

Calif., Los Angeles—Independent Paper Stock Co., 650 7th St., San Francisco, has awarded the contract for a waste materials plant to MacIsaac & Menke Co., 3440 East 22nd St. Estimated cost $147,900.

Calif., Ukiah—Masonite Corp., 111 Sutter St., San Francisco, has awarded the contract for a hardboard plant near here to Barrett & Hilp, 918 Harrison St., San Francisco. Estimated cost $1,000,000.

Conn., Montville—Robertson Paper Co., Montville has awarded the contract for the construction of 1 and 2 story factory buildings to Bartlett-Brainerd Co., 103 Woodbine St., Hartford. Estimated cost $75,000.

Ill., Chicago—U. S. Rubber Co., 440 West Washington St., has awarded the contract for a 1 story warehouse and office building to Poirot Construction Co., 2001 West Pershing Rd. Estimated cost $1,000,000.

La., Opelousas—Humble Oil & Refining Co., 1216 Main St., Houston, Tex., has awarded the contract for the construction of a refinery to Hudson Construction & Engineering Co., 2711 Danville St., Houston. Estimated cost $4,000,000.

N. J., Camden—National Waterproof Papers, Inc., 2nd and Beckett Sts., will construct a 1 story, 163x180 ft. factory. Work will be done by separate contracts. Estimated cost $125,000.

N. J., Eagle Point—The Texas Co., 135 East 42nd St., New York, N. Y., has awarded the contract for a 1 story storage building to Wigton-Abbott Corp., 1255 South Ave., Plainfield. Estimated cost $130,000.

N. Y., Beacon—The Texas Co., 135 East 42nd St., New York, N. Y., has awarded the contract for a research laboratory here to William A. Berbusse, Jr., Inc., 101 Park Ave., New York 17, N. Y. Estimated cost $2,000,000.

N. D., Fargo—Linde Air Products Co., Fargo, N. D., has awarded the contract for a plant to Meinecke-Johnson Co., 5 North 14th St. Estimated cost $200,000.

O., Clyde—Clyde Porcelain Steel Corp., Clyde, has awarded the contract for the construction of Plant No. 3 to Fremont Engineering Co., Fremont, O. Estimated cost $1,000,000.

Okla., Madill—Universal Gasoline Co., Madill, will construct a gasoline plant to utilize flare gas to have a daily capacity of 600,000 cu. ft. Work will be done with own forces. Estimated cost $350,000.

O., Cleveland—West Disinfecting Co., 1530 St. Clair Ave., has awarded the contract for a 1 and 2 story warehouse and office building at 3140 Berea Rd., to F. C. Douda Building Co., 1410 East 22nd St. Estimated cost $80,000.

O., Lima—Standard Oil Co. of Ohio, Midland Bldg., Cleveland, has awarded the contract for a solvent refining plant for lubricating oils and a solvent deasphalting unit to M. W. Kellogg Co., 225 Bway., New York, N. Y.; also four other units of solvent refining plant to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $13,000,000.

O., South Point—Solvay Process Div. of Allied Chemical & Dye Corp., 61 Bway., New York City, will construct a "Urea" plant here. Work will be done by separate contracts. Estimated cost between $2,000,000 and $3,000,000.

Pa., Easton—General Aniline & Film Corp., Grasselli, N. J., has awarded the contract for high pressure laboratory buildings to E. C. Machin Co., Inc., 1024 North Quebec St., Allentown. Estimated cost $150,000.

Pa., Kittanning—Linde Air Products Co., 205 East 42nd St., New York, N. Y., has awarded the contract of a 1 story factory addition to George W. Seaman & Co., 5145 Liberty Ave., Pittsburgh, Pa. Estimated cost $100,000.

Pa., Marcus Hook—Sun Oil Co., 1608 Walnut St., has awarded the contract for a 2 story, 40x540 ft. blending building to W. W. Lindsay & Co., Inc., 4 South 15th St. Estimated cost will exceed $250,000.

Tex., Baytown—United States Rubber Reserve, Baytown, will expand and remodel plant here to include the manufacture of "cold process" rubber, to be operated by General Tire & Rubber Co. Work will be done by subcontracts. Estimated cost $740,000.

Tex., Beaumont—United States Rubber Reserve, Beaumont, plans to expand its plant here to include the manufacture of "cold process" rubber, to be operated by B. F. Goodrich Rubber Co. Work will be done by subcontracts. Estimated cost $625,000.

Tex., Sunray—Shamrock Oil & Gas Co., Shamrock, will enlarge its refinery here. Work will be done by owners. Estimated cost $275,000.

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